

**EPA Superfund
Record of Decision:**

**CAROLAWN, INC.
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FORT LAWN, SC
09/27/1989**

Text :

- I) ALLUVIAL DEPOSITS;
- II) RESIDUAL AND COLUVIAL CLAYS;
- III) RESIDUUM AND SAPROLITE; AND
- IV) BEDROCK.

THE UPPER REGIONS OF THE BEDROCK HAVE BEEN ALTERED BY IN-SITU WEATHERING. THIS WEATHERING HAS PRODUCED A PARTIALLY TO HIGHLY DECOMPOSED MIXTURE OF ROCK AND SOIL WHICH IS REFERRED TO AS SAPROLITE. SAPROLITE RETAINS THE VESTIGIAL MINERALOGY AND STRUCTURE OF THE ORIGINAL ROCK.

THE BEDROCK BENEATH THE SITE HAS UNDERGONE SEVERAL EPISODES OF DEFORMATION. THESE EVENTS HAVE CREATED JOINTS AND FRACTURES. THESE STRUCTURAL FEATURES INFLUENCE GROUNDWATER FLOW WITHIN THE CRYSTALLINE BEDROCK. THE MAJOR STRUCTURAL FEATURES NOTED AT THE CAROLAWN SITE WERE JOINTS AND DIKES. JOINT MEASUREMENTS REVEALED THE PRESENCE OF THREE JOINT SETS WITH PRIMARY SETS STRIKING N45W AND N5W AND A MINOR SET STRIKING AT N35W. ALL JOINT SETS HAD VERTICAL TO SUBVERTICAL DIPS. THE MAFIC DIKE IDENTIFIED STRIKES AT APPROXIMATELY N45W AND IS MODERATELY WELL FRACTURED. FIGURE 5 PROVIDES THE ORIENTATION AND PROFILE LINES AS WELL AS THE DATA GENERATED IN THE MAGNETOMETER SURVEY OF THE SITE AND THE ORIENTATION OF THE MAFIC DIKE THAT RUNS THROUGH THE SITE.

THE MAJOR HYDROSTRATIGRAPHIC UNIT BENEATH THE SITE IS THE GRANODIORITE BEDROCK, SATURATED CONDITIONS WERE NOT ENCOUNTERED IN THE RESIDUUM/SAPROLITE UNIT. IT MAY BE POSSIBLE THAT THE RESIDUUM/SAPROLITE UNIT MAY USUALLY BE SATURATED BUT THE RI WAS CONDUCTED DURING AN EXTENDED DROUGHT AND ONLY UNSATURATED CONDITIONS WERE ENCOUNTERED IN THIS UNIT. THE GROUNDWATER IN THE BEDROCK IS ASSOCIATED WITH THE JOINTS AND FRACTURES.

ALL GROUNDWATER IN SOUTH CAROLINA IS CLASSIFIED AS CLASS GB WATERS (SOUTH CAROLINA REGULATION 61-68). THIS CLASSIFICATION MEANS THAT ALL GROUNDWATER MEETING THE DEFINITION OF UNDERGROUND SOURCES OF DRINKING WATER (USDW) MEET QUALITY STANDARDS SET FORTH IN THE STATE PRIMARY DRINKING WATER REGULATIONS (R.61-58.5). AN USDW IS DEFINED AS AN AQUIFER OR PORTION OF AN AQUIFER WHICH SUPPLIES, OR CONTAINS, SUFFICIENT QUANTITY OF WATER TO SUPPLY A PUBLIC SUPPLY SYSTEM.

ACCORDING TO USEPA GROUNDWATER CLASSIFICATION GUIDELINES OF DECEMBER 1986, THE BEDROCK AQUIFER BENEATH THE SITE IS CLASSIFIED AS CLASS IIA. IT IS CLASSIFIED AS CLASS IIA SINCE THE AQUIFER WAS USED AS A SOURCE OF DRINKING WATER WHEN THE SITE WAS IN OPERATION. IT IS ALSO ANTICIPATED THAT THERE ARE SEVERAL PRIVATE WELLS WITHIN THE TWO-MILE RADIUS THAT ARE CURRENTLY USING THIS AQUIFER AS A SOURCE OF POTABLE WATER. THEREFORE, THE GROUNDWATER SHOULD BE REMEDIATED TO LEVELS PROTECTIVE OF PUBLIC

HEALTH AND THE ENVIRONMENT.

THE ACTUAL DIRECTION OF GROUNDWATER FLOW THROUGH THE BEDROCK IS DEPENDENT UPON THE ORIENTATION OF THE JOINTS AND FRACTURES. THE GROUNDWATER CONTOURS (FIGURES 6, 7, AND 8) INDICATE THAT THE PREFERRED DIRECTION OF GROUNDWATER FLOW IS TO THE NORTH-EAST AND SOUTH-EAST. FIGURE 6 PRESENTS GROUNDWATER CONTOURS BASED ON GROUNDWATER LEVELS MEASURED IN AUGUST 1988. FIGURES 7 AND 8 ALSO SHOW GROUNDWATER CONTOURS BASED ON GROUNDWATER LEVEL MEASUREMENTS COLLECTED IN OCTOBER 1988 AND DECEMBER 1988, RESPECTIVELY.

HYDRAULIC DATA COLLECTED DURING THE RI INDICATES THAT FISHING CREEK IS THE PRIMARY RECEPTOR OF THE GROUNDWATER FLOWING UNDERNEATH THE SITE. THIS DATA ALSO INDICATES THAT THE MAFIC DIKE IDENTIFIED IN FIGURE 5 DOES NOT INFLUENCE, TO ANY GREAT DEGREE, THE HYDROLOGY OF THE SITE.

THE ESTIMATED GROUNDWATER FLOW VELOCITY IS 1.96×10^{-4} CENTIMETERS/SECOND (CM/SEC). THIS IS EQUIVALENT TO 0.56 FEET/DAY. BASED ON THIS VELOCITY, IT WOULD TAKE APPROXIMATELY SIX YEARS FOR GROUNDWATER ORIGINATING IN THE FENCED AREA TO REACH FISHING CREEK.

3.2 SITE CONTAMINATION

DUE TO THE EFFECTIVENESS OF THE REMOVAL ACTIONS, NO SOURCE CONTAMINATION REMAINS WITHIN THE FENCED AREA OF THE SITE. HOWEVER, SOME UNCERTAINTY EXISTS WITH RESPECT TO THE AREA NORTH OF THE FENCED AREA THAT WAS USED FOR STORAGE. ALTHOUGH THIS AREA WAS ADDRESSED DURING THE AGENCY'S REMOVAL ACTION, INSUFFICIENT CONFIRMATORY DATA HAS BEEN GENERATED TO SUBSTANTIATE THE ABSENCE OR PRESENCE OF SOIL CONTAMINATION.

THE ANALYTICAL GROUNDWATER DATA INDICATES THAT CONTAMINATION IS ENTERING FISHING CREEK VIA DISCHARGE OF GROUNDWATER TO THE CREEK.

3.3 AIR CONTAMINATION

THE MOST COMMON SOURCES OF AIR CONTAMINATION AT HAZARDOUS WASTE SITES ARE THE VOLATILIZATION OF TOXIC ORGANIC CHEMICALS AND THE SPREAD OF AIRBORNE CONTAMINATED DUST PARTICLES. DUE TO THE REMOVAL ACTIONS ALL CONTAMINATION AT THE SURFACE HAS BEEN ELIMINATED. THEREFORE, AS ANTICIPATED, NO AIRBORNE PROBLEMS WERE ENCOUNTERED DURING EITHER PHASE OF THE RI. THIS STATEMENT IS SUPPORTED BY THE FACT THAT ONLY BACKGROUND READINGS WERE RECORDED BY SITE PERSONNEL USING THE HNU PHOTOIONIZATION ANALYZER WHILE PERFORMING DESIGNATED RI TASKS. THE HNU WAS EMPLOYED TO MONITOR THE AIR AS A SAFETY MEASURE CALLED FOR BY THE HEALTH AND SAFETY PLAN.

3.4 SOIL CONTAMINATION

SURFICIAL AND SUBSURFACE SOIL SAMPLES WERE COLLECTED AND ANALYZED DURING PHASE I OF THE RI. FIGURE 9 PROVIDES THE LOCATION OF THE SAMPLING

POINTS AND THE CONTAMINANTS DETECTED IN THE SAMPLE(S) COLLECTED FROM THESE POINTS. ALL SOIL SAMPLES WERE ANALYZED FOR THE PRIORITY POLLUTANT LIST COMPOUNDS. A SUMMARY OF THE DETECTED COMPOUNDS IN THE SURFACE AND SUB-SURFACE SOIL SAMPLES IS PRESENTED IN TABLES 1 AND 2, RESPECTIVELY. EXAMINATION OF TABLE 1 INDICATES THAT METHYLENE CHLORIDE AND ACETONE WERE DETECTED IN ALL SURFACE SOIL SAMPLES, HOWEVER, THESE COMPOUNDS WERE ALSO DETECTED IN THE LABORATORY BLANKS. THEREFORE, THESE CONTAMINANTS ARE LIKELY THE RESULT OF LABORATORY CONTAMINATION. THE ONLY BASE NEUTRAL EXTRACTABLE DETECTED WAS BIS(2-ETHYL HEXYL)PHTHALATE. THERE IS GOOD EVIDENCE THAT THIS TOO MAY HAVE BEEN A CONTAMINANT INTRODUCED INTO THE SAMPLE. IT IS THE AGENCY'S OPINION THAT THESE CONTAMINANTS ARE NOT PRESENT IN THE SOILS OF THE SITE AS THE ANALYTICAL DATA WOULD LEAD A PERSON TO BELIEVE BUT THE RESULT OF CROSS-CONTAMINATION.

SEVERAL METALS WERE DETECTED IN THE SURFICIAL SOIL SAMPLES. THE HIGHEST CONCENTRATIONS WERE FOR LEAD, CHROMIUM AND BARIUM. WITHOUT REPRESENTATIVE BACKGROUND DATA, IT IS THE AGENCY'S CONTENTION THAT THE ELEVATED LEVELS OF LEAD AND CHROMIUM ARE THE RESULT OF PAST ACTIVITIES AT THE SITE.

TABLE 3 PRESENTS THE GENERAL RANGE AND TYPICAL MEDIUM CONCENTRATIONS OF VARIOUS METALS IN SOILS. A COMPARISON OF THE LEVELS OF METALS COLLECTED AT THE SITE WITH THE AVERAGE METAL CONCENTRATIONS TYPICALLY FOUND IN SOIL IS PRESENTED IN TABLE 4.

IN LIGHT OF THE ABOVE INFORMATION, IT IS THE AGENCY'S OPINION THAT THE REMOVAL ACTIONS HAVE ELIMINATED FUTURE SOURCES OF CONTAMINATION AT THE SITE WITHIN THE FENCED AREA. SOME ADDITIONAL ENVIRONMENTAL SAMPLING NEEDS TO BE PERFORMED IN THE STORAGE AREA NORTH OF THE FENCED AREA (FIGURE 4) TO CONFIRM THE ABSENCE OR PRESENCE OF CONTAMINATION. ALTHOUGH NO SOURCE REMEDIATION IS REQUIRED WITHIN THE FENCED AREA OF THE SITE, THERE IS SOME QUESTION AS TO THE PRESENCE OF RESIDUAL SOIL CONTAMINATION IN THIS STORAGE AREA NORTH OF THE FENCED AREA. IF CONTAMINATION IS FOUND, THEN THIS ROD WILL NEED TO BE AMENDED.

3.5 GROUNDWATER CONTAMINATION

TWO ROUNDS OF GROUNDWATER SAMPLES WERE COLLECTED DURING PHASE I. THE FIRST ROUND WAS ANALYZED FOR USEPA PRIORITY POLLUTANTS AND THE SECOND ROUND WAS ANALYZED FOR VOCs AND SELECTED INORGANICS. THE WELLS SAMPLED IN PHASE I WERE MONITOR WELLS MW-1, MW-2, MW-3, MW-4 AND PRIVATE WELLS RW1 (ROCKHOLT), RW2 (HUNTER), RW3 (M. MORRISON), AND RW4 (M. MORRISON). THE LOCATION OF THESE WELLS CAN BE FOUND IN FIGURES 3 AND 10. THE ANALYTICAL DATA IS PRESENTED IN TABLE 5.

AS PART OF PHASE II ACTIVITIES, NINE (9) ADDITIONAL MONITOR WELLS WERE INSTALLED AT SEVEN (7) LOCATIONS. THE LOCATIONS ARE SHOWN ON FIGURE 11. THREE ROUNDS OF SAMPLES WERE COLLECTED AS PART OF PHASE II ACTIVITIES. DURING THE FIRST ROUND OF SAMPLING WELLS MW5-88 AND MW6-88 WERE ANALYZED FOR THE USEPA TARGET COMPOUND LIST (TCL). THE USEPA TCL IS EQUIVALENT

TO THE USEPA PRIORITY POLLUTANT LIST. ALL THE REST OF THE GROUNDWATER SAMPLES WERE ANALYZED FOR TCL VOLATILE ORGANIC COMPOUNDS (VOCS). A SUMMARY OF THE RESULTS OF THE ANALYSES ARE PRESENTED IN TABLES 6 AND 7.

BELOW ARE BRIEF DESCRIPTIONS OF THE FINDINGS OF THE GROUNDWATER INVESTIGATION.

FOR VOCS: SEVERAL TCL VOCS WERE DETECTED IN THE MONITOR WELLS AND DOMESTIC WELLS SAMPLED DURING BOTH PHASES. THE COMPOUNDS FOUND IN THE HIGHEST CONCENTRATIONS INCLUDED ACETONE AND TRICHLOROETHYLENE (TCE). OTHER VOCS WERE DETECTED IN A FEWER NUMBER OF WELLS. AFTER REVIEWING THE QA/QC DATA, IT IS THE AGENCY'S OPINION THAT THE METHYLENE CHLORIDE FOUND IN SOME OF THE GROUNDWATER SAMPLES WAS DUE TO LABORATORY CROSS-CONTAMINATION AND NOT A CONSTITUENT OF THE GROUNDWATER. THIS CONCLUSION IS SUPPORTED BY THE FACT THAT METHYLENE CHLORIDE WAS FOUND IN THE LABORATORY BLANKS.

FIGURES 12 AND 13 PROVIDE A VISUAL PRESENTATION OF GROUNDWATER CONTAMINATION DETECTED IN THE TWO SAMPLING ROUNDS CONDUCTED DURING PHASE I. FIGURE 12 DEPICTS THE DISTRIBUTION OF ORGANICS IN THE GROUNDWATER AND FIGURE 13, THE DISTRIBUTION OF THE INORGANIC CONTAMINANTS. FIGURES 14 AND 15 PROVIDE A VISUAL DISTRIBUTION OF ACETONE AND TCE CONTAMINATION OF GROUNDWATER FOUND DURING PHASE II. EXAMINATION OF THESE FIGURES INDICATE THAT THE CONTAMINANTS ARE BEING TRANSPORTED THROUGH THE FRACTURES AND JOINTS IN THE BEDROCK ALONG WITH THE GROUNDWATER. AS STATED PREVIOUSLY, THE MAFIC DIKE HAS LITTLE EFFECT ON GROUNDWATER FLOW AND THEREFORE, THE DISTRIBUTION OF THE CONTAMINANTS IN THE GROUNDWATER.

FOR BASE NEUTRAL/ACID EXTRACTABLES (BNAS): THE ONLY BNA DETECTED IN EITHER PHASE I OR II WAS IN WELL MW-4. BIS(2-ETHYL HEXYL)PHTHALATE, A COMMON CROSS-CONTAMINANT IN MONITOR WELLS, WAS FOUND IN THE FIRST ROUND OF SAMPLES COLLECTED DURING PHASE I.

FOR POLYCHLORINATED BIPHENYLS (PCBS)/PESTICIDES: NEITHER PCBS NOR PESTICIDES WERE DETECTED IN ANY GROUNDWATER SAMPLES COLLECTED DURING THE RI.

FOR METALS: A NUMBER OF TCL METALS WERE DETECTED IN THE PHASE I SAMPLES AND IN THE GROUNDWATER SAMPLES PULLED FROM MW5-88 AND MW6-88 DURING PHASE II. LEAD WAS DETECTED AT CONCENTRATIONS FROM 2.6 TO 28.0 UG/L IN VARIOUS MONITOR WELLS IN PHASE I. LEAD WAS ALSO DETECTED IN ROUND 1 SAMPLING OF PHASE II IN MW5-88 AND MW6-88 AT CONCENTRATIONS OF 8.2 MICROGRAMS PER LITER (UG/L) AND 80 UG/L, RESPECTIVELY. THIS DATA IS PRESENTED IN TABLES 5 AND 7. THE PRESENT MAXIMUM CONCENTRATION LIMIT (MCL) FOR LEAD IS 50 UG/L BUT IN AUGUST, 1988, EPA PROPOSED A MCL OF 5 UG/L (FEDERAL REGISTER: VOLUME 53, NO. 160). IN ADDITION, CHROMIUM WAS ALSO DETECTED IN MW6 AT A CONCENTRATION OF 80 UG/L (TABLE 7) WHICH EXCEEDS THE PRESENT MCL OF 50 UG/L.

3.6 SURFACE WATER AND SEDIMENT

SURFACE WATER RUNOFF FROM THE SITE IS CHanneLED INTO DITCHES THAT ARE LOCATED IN THE NORTH, EAST AND WEST SIDES OF THE FENCED AREA AS CAN BE SEEN IN FIGURE 16. THESE DITCHES DIRECT SURFACE RUNOFF TO FISHING CREEK AND CONTAIN FLOWING WATER ONLY DURING WET PERIODS. FIGURE 16 ALSO SHOWS THE SAMPLING LOCATION FOR SAMPLES COLLECTED AS PART OF THE HAZARDOUS WASTE SITE INVESTIGATION (HWSI) CONDUCTED IN AUGUST 1981. TABLE 8 PROVIDES A BRIEF DESCRIPTION OF THE HWSI SAMPLING LOCATIONS. TABLES 9 AND 10 SUMMARIZE THE COMPOUNDS DETECTED IN THE AUGUST 1981 HWSI.

SURFACE WATER AND SEDIMENT SAMPLES WERE COLLECTED DURING BOTH PHASE I AND II, HOWEVER, ONLY FISHING CREEK WAS SAMPLED DURING PHASE II. FIGURE 17 SHOWS THE SAMPLING LOCATIONS IN PHASE I. FIGURE 18 IDENTIFIES THE SAMPLING POINTS FOR SAMPLES COLLECTED FROM FISHING CREEK DURING PHASE II. THE ANALYTICAL RESULTS OF PHASE I SURFACE WATER/SEDIMENT SAMPLING ARE GIVEN IN TABLE 11 AND THE RESULTS OF PHASE II SAMPLING/ANALYSES ARE PRESENTED IN TABLE 12.

THE PHASE I SURFACE WATER DATA INDICATES THAT THE CONCENTRATIONS OF METALS AND SEMI-VOLATILE ORGANIC COMPOUNDS WERE BELOW MINIMUM DETECTION LIMITS. THE ONLY VOLATILE ORGANIC COMPOUND DETECTED, WHICH ALSO WAS FOUND IN THE LABORATORY BLANK, WAS METHYLENE CHLORIDE.

THE SIX SEDIMENT SAMPLES COLLECTED DURING PHASE I INDICATE THE PRESENCE OF ACETONE AND ELEVATED LEVELS OF LEAD AND ARSENIC. THE ELEVATED METAL LEVELS WERE DETECTED IN THE SEDIMENT COLLECTED FROM THE WEST DITCH.

ALL PHASE II SURFACE WATER SAMPLES COLLECTED WERE ANALYZED FOR TCL VOCS. EXAMINATION OF THESE DATA INDICATES THAT ONLY ACETONE WAS DETECTED. NO OTHER VOCS WERE DETECTED. IT IS POSSIBLE THAT THE ACETONE IS THE RESULT OF SAMPLING AND/OR LABORATORY CONTAMINATION AS ACETONE WAS NOT DETECTED IN THE DUPLICATE SAMPLE COLLECTED AT STATION 1 DURING ROUND 2 OF SAMPLING. HOWEVER, ACETONE IS A CONFIRMED CONTAMINANT IN THE GROUNDWATER THAT IS DISCHARGING TO FISHING CREEK.

THE SURFACE WATER ANALYSES CONDUCTED DURING THE RI INDICATES THAT THE DISCHARGE OF GROUNDWATER TO FISHING CREEK HAS NOT HAD A MEASUREABLE IMPACT ON THE WATER QUALITY IN FISHING CREEK.

THE GEOMETRIC MEAN OF FLOW IN FISHING CREEK IS 45.45 CUBIC FEET PER SECOND. FIGURE 19 DEPICTS THE 100-YEAR FLOOD ZONE FOR FISHING CREEK.

3.7 RISK ASSESSMENT SUMMARY

THE CHEMICALS OF POTENTIAL CONCERN IDENTIFIED FOR THE SITE ARE VOLATILE ORGANIC COMPOUNDS AND ONE HEAVY METAL. MORE SPECIFICALLY: ACETONE, 1,1-DICHLOROETHANE (1,1 DCA), 1,1-DICHLOROETHENE (1,1 DCE), 1,2-DICHLOROETHENE (1,2 DCE), 1,1,1-TRICHLOROETHANE (1,1,1 TCA), TRICHLOROETHENE (TCE) AND LEAD.

UNDER PRESENT CONDITIONS, THE RISK POSED BY THE INHALATION OF VAPORS AND SUSPENDED CONTAMINATED PARTICULATES IN AIR HAS A VERY LOW PROBABILITY. ALTHOUGH THE CHEMICALS OF CONCERN FOR THE SITE ARE VOLATILE ORGANICS, THE REMOVAL OF THE CONTAMINATED SOILS AND SUBSEQUENT BACK FILLING WITH CLEAN FILL BY EPA IN 1982 ELIMINATED THIS PATHWAY. EPA'S 1982 REMOVAL WAS AUGMENTED BY THE PRP SPONSORED 1986 REMOVAL ACTION. INORGANICS CHEMICALS ARE REPORTED IN SURFACE SOIL BUT AT LEVELS THAT ARE TYPICAL FOR SOILS IN GENERAL. DUST EXPOSURE IS FURTHER LIMITED BY A GENERAL COVERING OF VEGETATION OVER THE SITE. THIS ROUTE OF EXPOSURE MAY BECOME IMPORTANT AND REQUIRE FURTHER CONSIDERATION IF AIR STRIPPING IS USED AS PART OF THE TREATMENT TRAIN FOR REMEDIATING CONTAMINATED GROUNDWATER.

EXPOSURE TO CONTAMINATED SURFACE SOIL AT THE SITE WAS ALSO EVALUATED. AS WITH THE POTENTIAL FOR EXPOSURE VIA THE AIR PATHWAY, THE POTENTIAL TO EXPOSURE TO CONTAMINATED SURFACE SOILS HAVE ALSO BEEN ELIMINATED BY THE REMOVAL ACTIONS TAKEN AT THE SITE. THEREFORE, EXPOSURE TO SOIL IS NOT CONSIDERED A RISK.

THERE IS ONE DOMESTIC WATER SUPPLY WELLS DRAWING WATER FROM THE BEDROCK AQUIFER IN THE IMMEDIATE VICINITY OF THE SITE. THE OTHER RESIDENCES ADJACENT TO THE SITE WHICH HAD PRIVATE POTABLE WELLS WERE CONNECTED TO THE PUBLIC WATER SUPPLY SYSTEM IN 1985 AS AN ALTERNATIVE WATER SUPPLY. THE LAST TIME THE PRIVATE WELL CURRENTLY BEING USED WAS SAMPLED WAS IN 1986. THE ANALYTICAL DATA IS PRESENTED IN TABLE 5. THIS WELL IS LOCATED UPGRADIENT OF THE SITE AND NO CONTAMINATION HAS BEEN FOUND IN THIS RESIDENTIAL WELL. HOWEVER, THERE ARE CONTAMINANTS PRESENT IN THE GROUNDWATER DOWNGRADIENT AND BEYOND THE PROPERTY LINES OF THE SITE AT CONCENTRATIONS THAT EXCEED DRINKING WATER STANDARDS AND/OR CRITERIA. SINCE THIS LAND DOWNGRADIENT OF THE SITE IS PRIVATELY OWNED, THERE IS A POSSIBILITY THAT SOME TIME IN THE FUTURE A PRIVATE WATER SUPPLY WELL COULD BE INSTALLED DOWNGRADIENT OF THE SITE IN THE CONTAMINATED AQUIFER. THEREFORE, POTENTIAL FUTURE EXPOSURE PATHWAYS TO CONTAMINATED GROUNDWATER EXIST. THEY CONSIST OF CONSUMPTION, INHALATION AND DERMAL ABSORPTION.

FISHING IN FISHING CREEK CAN OCCUR AND SINCE FISHING CREEK IS THE PRIMARY RECEPTOR OF GROUNDWATER FLOWING BENEATH THE SITE, CONTAMINANTS EMANATING FROM THE SITE ARE ENTERING THE CREEK WITH THE DISCHARGING GROUNDWATER. THEREFORE, THE EXPOSURE RESULTING FROM THE CONSUMPTION OF FISH FROM FISHING CREEK WAS EVALUATED.

SWIMMING IN FISHING CREEK IS ALSO A POSSIBLE ACTIVITY WHICH COULD RESULT IN EXPOSURE TO CONTAMINANTS ORIGINATING FROM THE SITE. THEREFORE, THE EXPOSURE TO THE SURFACE WATERS IN FISHING CREEK WAS EVALUATED AS A POTENTIAL PATHWAY OF EXPOSURE.

TABLE 13 SUMMARIZES THE POTENTIAL RELEASE MECHANISMS TO THE FOUR PRIMARY, ENVIRONMENTAL MEDIUMS OF CONCERN: AIR, SURFACE WATER AND SEDIMENT, GROUNDWATER, AND SOILS. TABLE 14 SUMMARIZES THE IDENTIFIED POTENTIAL HUMAN EXPOSURE PATHWAYS ASSOCIATED WITH CAROLAWN SITE.

IN SUMMARY, THE MEDIA AND EXPOSURE PATHWAYS WHICH WERE EXAMINED ARE:

- I) INHALATION, CONSUMPTION AND DERMAL CONTACT OF CONTAMINATED GROUNDWATER;
- II) INHALATION, CONSUMPTION AND DERMAL CONTACT OF CONTAMINATED SURFACE WATER; AND
- III) CONSUMPTION OF CONTAMINATED FISH FROM FISHING CREEK.

NO ENDANGERED SPECIES WERE IDENTIFIED LIVING ON OR NEAR THE SITE, AND NO SENSITIVE ENVIRONMENTS ARE IMPACTED BY THE SITE.

CANCER POTENCY FACTORS (CPFS) HAVE BEEN DEVELOPED BY EPA'S CARCINOGENIC ASSESSMENT GROUP FOR ESTIMATES EXCESS LIFETIME CANCER RISKS ASSOCIATED WITH EXPOSURE TO POTENTIALLY CARCINOGENIC CHEMICALS. CPFS, WHICH ARE EXPRESSED IN UNITS OF (MILLIGRAMS/KILOGRAM-DAY)(-1), ARE MULTIPLIED BY THE ESTIMATED INTAKE OF A POTENTIAL CARCINOGEN, IN MILLIGRAMS/KILOGRAM-DAY, TO PROVIDE AN UPPER-BOUND ESTIMATE OF THE EXCESS LIFETIME CANCER RISK ASSOCIATED WITH EXPOSURE AT THAT INTAKE LEVEL. THE TERM "UPPER BOUND" REFLECTS THE CONSERVATIVE ESTIMATE OF THE RISKS CALCULATED FROM THE CPF. USE OF THIS APPROACH MAKES UNDERESTIMATION OF THE ACTUAL CANCER RISK HIGHLY UNLIKELY. CANCER POTENCY FACTORS ARE DERIVED FROM THE RESULTS OF HUMAN EPIDEMIOLOGICAL STUDIES OR CHRONIC ANIMAL BIOASSAYS TO WHICH ANIMAL-TO-HUMAN EXTRAPOLATION AND UNCERTAINTY FACTORS HAVE BEEN APPLIED.

REFERENCE DOSES (RFDs) HAVE BEEN DEVELOPED BY EPA FOR INDICATING THE POTENTIAL FOR ADVERSE HEALTH EFFECTS FROM EXPOSURE TO CHEMICALS EXHIBITING NONCARCINOGENIC EFFECTS. RFDs, WHICH ARE EXPRESSED IN UNITS OF MILLIGRAMS/KILOGRAM-DAY, ARE ESTIMATES OF LIFETIME DAILY EXPOSURE LEVELS FOR HUMANS, INCLUDING SENSITIVE INDIVIDUALS. ESTIMATED INTAKES OF CHEMICALS FROM ENVIRONMENTAL MEDIA (E.G., THE AMOUNT OF A CHEMICAL INGESTED FROM CONTAMINATED DRINKING WATER) CAN BE COMPARED TO THE RFD. RFDs ARE DERIVED FROM HUMAN EPIDEMIOLOGICAL STUDIES OR ANIMAL STUDIES TO WHICH UNCERTAINTY FACTORS HAVE BEEN APPLIED (E.G., TO ACCOUNT FOR THE USE OF ANIMAL DATA TO PREDICT EFFECTS ON HUMANS). THESE UNCERTAINTY FACTORS HELP ENSURE THAT RFDs WILL NOT UNDERESTIMATE THE POTENTIAL FOR ADVERSE NONCARCINOGENIC EFFECTS TO OCCUR.

EXCESS LIFETIME CANCER RISKS ARE DETERMINED BY MULTIPLYING THE INTAKE LEVEL WITH THE CANCER POTENCY FACTOR. THESE RISKS ARE PROBABILITIES THAT ARE GENERALLY EXPRESSED IN SCIENTIFIC NOTATION (E.G., 1×10^{-6}) OR $1E-6$). AN EXCESS LIFETIME CANCER RISK OF 1×10^{-6} INDICATES THAT, AS A PLAUSIBLE UPPER BOUND, AN INDIVIDUAL HAS A ONE IN ONE MILLION CHANCE OF DEVELOPING CANCER AS A RESULT OF SITE-RELATED EXPOSURE TO A CARCINOGEN OVER A 70-YEAR LIFETIME UNDER THE SPECIFIC EXPOSURE CONDITIONS AT A SITE.

POTENTIAL CONCERN FOR NONCARCINOGENIC EFFECTS OF A SINGLE CONTAMINANT IN A SINGLE MEDIUM IS EXPRESSED AS THE HAZARD QUOTIENT (HQ) (OR THE RATIO

OF THE ESTIMATED INTAKE DERIVED FROM THE CONTAMINANT CONCENTRATION IN A GIVEN MEDIUM TO THE CONTAMINANT'S RFD). BY ADDING THE HQS FOR ALL CONTAMINANTS WITHIN A MEDIUM OR ACROSS ALL MEDIA TO WHICH A GIVEN POPULATION MAY REASONABLY BE EXPOSED, THE HAZARD INDEX (HI) CAN BE GENERATED. THE HI PROVIDES A USEFUL REFERENCE POINT FOR GAUGING THE POTENTIAL SIGNIFICANCE OF MULTIPLE CONTAMINANT EXPOSURES WITHIN A SINGLE MEDIUM OR ACROSS MEDIA.

3.7.1 HEALTH RISK ASSOCIATED WITH GROUNDWATER

THE HEALTH RISK ASSOCIATED WITH EXPOSURE TO CONTAMINATED GROUNDWATER OFF-SITE IS SUMMARIZED BELOW.

1,1-DICHLOROETHENE AND TRICHLOROETHENE EXCEED MAXIMUM CONCENTRATION LIMITS (MCLS) IN THE GROUNDWATER OFF-SITE. TABLE 15 PRESENTS CONCENTRATIONS AND RELATED ESTIMATED HEALTH RISKS IN WELLS WHICH REPRESENT THE FENCE LINE GROUNDWATER CONDITIONS. ESTIMATES OF FUTURE MAXIMUM CONCENTRATIONS OF GROUNDWATER CONCENTRATIONS IMMEDIATELY UPGRADIENT (TOWARD THE SITE) FROM FISHING CREEK AND THE RELATED HEALTH RISKS ARE PRESENTED IN TABLE 16. TABLE 17 PRESENTS LEAD CONCENTRATIONS IN GROUNDWATER. ESTIMATES OF MEAN GROUNDWATER LEAD CONCENTRATIONS WERE DETERMINED BY AVERAGING DETECTED LEAD CONCENTRATIONS, AND ASSIGNING THE DETECTION LIMIT CONCENTRATION OF 5 MICROGRAMS/LITER (UG/L) TO SAMPLES WITH NON-DETECT RESULTS. MEAN OF 19 UG/L AND 9 UG/L WERE CALCULATED FOR MONITOR WELLS MW-1 TO MW-4 AND RESIDENTIAL WELLS RW-1 TO RW-4, RESPECTIVELY. THESE MEAN CONCENTRATIONS ARE BELOW THE EXISTING MCL OF 50 UG/L BUT IS ABOVE THE PROPOSED NEW MCL FOR LEAD WHICH IS 5 UG/L.

THE LIFETIME CANCER RISK DUE TO EXPOSURE TO THESE CARCINOGENIC COMPOUNDS AT PRESENT CONCENTRATIONS RANGES FROM 1.64×10^{-3} TO 8.40×10^{-5} . THIS RISK RANGE IS ABOVE THE RANGE OF RISKS (1×10^{-4} TO 1×10^{-6}) CONSIDERED BY EPA TO BE PROTECTIVE OF PUBLIC HEALTH. THEREFORE, GROUNDWATER AT THESE LEVELS OF CONTAMINATION ARE CONSIDERED UNACCEPTABLE FOR HUMAN CONSUMPTION.

3.7.2 HEALTH RISK ASSOCIATED WITH SURFACE WATER - OFF-SITE

THE HEALTH RISK ASSOCIATED WITH EXPOSURE TO CONTAMINATED SURFACE WATER OFF-SITE IS SUMMARIZED BELOW.

THE ESTIMATED LIFETIME CANCER RISK DUE TO EXPOSURE OF CONTAMINANT CONCENTRATIONS THAT ARE AND WILL BE PRESENT IN FISHING CREEK RANGES FROM 7.3×10^{-11} TO 4.8×10^{-12} FOR SWIMMERS. THIS IS BELOW THE ACCEPTABLE RANGE OF 1×10^{-4} TO 1×10^{-6} . CONSEQUENTLY, THERE IS NO INCREASE IN HEALTH RISKS TO SWIMMERS DUE TO THE EXPOSURE TO THE IDENTIFIED INDICATOR CHEMICALS FOR THE CAROLAWN SITE IN FISHING CREEK.

TABLE 18 PROVIDES THE ASSUMPTIONS MADE FOR ESTIMATING EXPOSURE RISKS FOR SWIMMING IN FISHING CREEK AND TABLE 19 SUMMARIZES THE ESTIMATED HEALTH RISK DUE TO EACH CHEMICAL.

3.7.3 HEALTH RISK ASSOCIATED WITH THE CONSUMPTION OF FISH

USING THE ASSUMPTIONS THAT AN INDIVIDUAL CONSUMES BETWEEN 14 TO 42 GRAMS OF FISH PER DAY FOR HIS ENTIRE LIFETIME AND THAT 10 PERCENT OF THESE FISH CONSUMED COME FROM FISHING CREEK, THE ESTIMATED INCREASED LIFETIME RISK OF CANCER RANGES FROM 1.7×10^{-8} TO 2.7×10^{-9} . THIS RANGE ALSO FALLS BELOW THE ACCEPTABLE RANGE OF 1×10^{-4} TO 1×10^{-6} . CONSEQUENTLY, THERE IS NO QUANTIFIABLE INCREASE IN THE HEALTH RISK DUE TO THE CONSUMPTION OF FISH CAUGHT IN FISHING CREEK. TABLE 20 PROVIDES THE ASSUMPTIONS USED FOR ESTIMATING EXPOSURE RISKS FOR CONSUMING FISH FROM FISHING CREEK AND TABLE 21 SUMMARIZES THE ESTIMATED HEALTH RISK DUE TO SITE RELATED CHEMICALS FROM THE CONSUMPTION OF FISH FROM FISHING CREEK.

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4.0 CLEANUP CRITERIA

THE EXTENT OF CONTAMINATION WAS DEFINED IN SECTION 3.0, CURRENT SITE STATUS. SECTION 4.0 EXAMINES THE ARARS ASSOCIATED WITH THE CONTAMINANTS FOUND ON SITE AND THE ENVIRONMENTAL MEDIUM CONTAMINATED. AS DISCUSSED EARLIER, THE PRIMARY ENVIRONMENTAL MEDIUM OF CONCERN WHERE CONCENTRATIONS OF CONTAMINANTS REMAIN THAT COULD PROVE DETRIMENTAL TO THE PUBLIC HEALTH AND THE ENVIRONMENT IS IN THE GROUNDWATER. TABLE 22 PROVIDES A SUMMARY OF THE CONTAMINANTS OF CONCERN IN THE GROUNDWATER, THE SPECIFIC CLEAN-UP GOAL FOR EACH CONTAMINANT, AND THE SOURCE FOR THE SPECIFIED ARAR.

DEPENDING ON THE RESULTS FROM THE CONFIRMATION SOIL SAMPLING IN THE STORAGE AREA NORTH OF THE FENCED AREA, BOTH TABLES 22 AND 23 MAY BE EXPANDED TO INCLUDE SOIL CLEANUP GOALS. TABLE 23 PROVIDES THE CLEANUP GOALS FOR THE CONTAMINANTS OF CONCERN AT THE CAROLAWN SITE.

4.1 GROUNDWATER REMEDIATION

IN DETERMINING THE DEGREE OF GROUNDWATER CLEAN-UP, SECTION 121(D) OF THE SUPERFUND AMENDMENT AND REAUTHORIZATION ACT OF 1986 (SARA) REQUIRES THAT THE SELECTED REMEDIAL ACTION ESTABLISH A LEVEL OR STANDARD OF CONTROL WHICH COMPLIES WITH ALL ARARS, BE COST-EFFECTIVE AND ACHIEVE A CLEAN-UP LEVEL THAT IS PROTECTIVE OF HUMAN HEALTH AND THE ENVIRONMENT. FINALLY, THE REMEDY SHOULD UTILIZE PERMANENT TREATMENT TECHNOLOGIES TO THE MAXIMUM EXTENT PRACTICABLE.

FOR THOSE CONTAMINANTS FOUND IN THE GROUNDWATER AT THE SITE, TABLE 23 PRESENTS THE REMEDIATION LEVELS THE REMEDIAL ALTERNATIVE NEEDS TO ACHIEVE.

4.2 SOIL REMEDIATION

THE FINDINGS PRESENTED IN THE RI (THE PUBLIC HEALTH EVALUATION {CHAPTER 7.0} OF THE RI) INDICATES THAT THE SOILS INSIDE THE FENCED AREA DO NOT POSE A RISK TO THE PUBLIC HEALTH OR THE ENVIRONMENT. THEREFORE, NO REMEDIATION IS PROPOSED FOR THIS ENVIRONMENTAL MEDIUM.

AS DISCUSSED ABOVE, THE SOILS IN THE AREA NORTH OF THE FENCED AREA, DEPENDING ON THE CONFIRMATORY SAMPLES, MAY REQUIRE REMEDIATION.

4.3 SURFACE WATER/SEDIMENT REMEDIATION

ONLY METHYLENE CHLORIDE, WHICH IS BELIEVED TO BE A LABORATORY INDUCED CONTAMINANT BASED ON QA/QC DATA, AND ACETONE WERE DETECTED IN THE SURFACE WATER SAMPLES. ACETONE WAS FOUND SPORADICALLY IN THE SAMPLES COLLECTED. NO OTHER TCL COMPOUNDS WERE DETECTED IN THE WATER COLUMN.

THE SEDIMENT SAMPLES COLLECTED FROM THE DRAINAGE COURSES NEAR THE SITE AND FISHING CREEK DID NOT CONTAIN ANY TCL ORGANIC COMPOUNDS ATTRIBUTABLE TO THE SITE. THE TOTAL METALS CONCENTRATIONS ARE WITHIN TYPICAL NATURAL LEVELS FOR SOILS WITH SIMILAR GEOGRAPHICAL CONDITIONS AS FOUND AS THE CAROLAWN SITE.

BOTH THESE FACTS INDICATES THAT THE OVERLAND FLOW AND SURFACE WATER RUNOFF FROM THE SITE HAS NOT RESULTED IN THE ACCUMULATION OF CONTAMINATION IN THE DRAINAGE COURSES. EVEN UNDER 7Q10 FLOW CONDITIONS, THE RATE AND LEVEL OF DISCHARGE OF CONTAMINANTS WITH THE GROUNDWATER INTO FISHING CREEK WILL NOT SURPASS THE AMBIENT WATER QUALITY CRITERIA (AWQC) FOR THE CONTAMINANTS OF CONCERN. THE AWQC ARE LISTED IN TABLE 22.

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5.0 ALTERNATIVES EVALUATED

THE PURPOSE OF THE REMEDIAL ACTION AT THE CAROLAWN SITE IS TO MINIMIZE, IF NOT MITIGATE CONTAMINATION IN THE GROUNDWATER AND TO REDUCE, IF NOT ELIMINATE, POTENTIAL RISKS TO HUMAN HEALTH AND THE ENVIRONMENT. THE FOLLOWING CLEAN-UP OBJECTIVES WERE DETERMINED BASED ON REGULATORY REQUIREMENTS AND LEVELS OF CONTAMINATION FOUND AT THE SITE:

- * PREVENT THE NEAR-TERM AND FUTURE EXPOSURE OF HUMAN RECEPTORS TO CONTAMINATED GROUNDWATER BOTH ON AND OFF SITE;
- * RESTORE THE CONTAMINATED AQUIFER FOR FUTURE USE BY REDUCING CONTAMINANT LEVELS TO THOSE WHICH WILL ADEQUATELY PROTECT HUMAN HEALTH AND THE ENVIRONMENT;
- * CONTROL CONTAMINANT MIGRATION SO CONTAMINANT RELEASES FROM GROUNDWATER TO FISHING CREEK DO NOT EXCEED CLEAN UP CRITERIA TO HUMAN HEALTH AND THE ENVIRONMENT;

- * MONITOR GROUNDWATER IN A MANNER TO VERIFY EFFECTIVENESS OF REMEDIAL MEASURES; AND
- * CONFIRM ABSENCE/PRESENCE OF SOIL CONTAMINATION IN STORAGE AREA NORTH OF THE FENCED AREA.

TABLE 24 PROVIDES A LIST OF POSSIBLE REMEDIAL TECHNOLOGIES APPLICABLE AT THE CAROLAWN SITE KNOWING THE ENVIRONMENTAL MEDIA AFFECTED, THE TYPE OF CONTAMINANTS PRESENT AND THE CONCENTRATION OF EACH CONTAMINANT IN EACH ENVIRONMENTAL MEDIUM. THE INITIAL SCREENING EVALUATES THE TECHNOLOGIES ON THE FOLLOWING TECHNICAL PARAMETERS:

- * IMPLEMENTABILITY,
- * RELIABILITY AND EFFECTIVENESS, AND
- * PREVIOUS EXPERIENCE.

TABLE 25 PROVIDES A SUMMARY OF THE INITIAL SCREENING OF THE REMEDIAL TECHNOLOGIES AND THE RATIONALE AS TO WHY CERTAIN TECHNOLOGIES WERE ELIMINATED FROM FUTURE CONSIDERATION.

THESE TECHNOLOGIES ADDRESS GROUNDWATER AND BEST MEET THE CRITERIA OF SECTION 300.65 OF THE NATIONAL CONTINGENCY PLAN (NCP).

FOLLOWING THE INITIAL SCREENING OF THE INDIVIDUAL TECHNOLOGIES, THESE TECHNOLOGIES WERE COMBINED TO FORM A NUMBER OF REMEDIAL ACTION ALTERNATIVES. THESE REMEDIAL ACTION ALTERNATIVES ARE THEN SCREENED AND ANALYZED IN RELATION TO THE NINE POINT CRITERIA. TABLE 26 LISTS THE FIVE REMEDIAL ALTERNATIVES AND REMEDIAL TECHNOLOGIES (COMPONENTS) INVOLVED IN EACH ALTERNATIVE.

5.0.1 ALTERNATIVE 1 - NO ACTION

THE "NO ACTION" ALTERNATIVE ASSUMES THAT NO REMEDIATION OF THE CONTAMINATED GROUNDWATER, OTHER THAN BY NATURAL ATTENUATION WOULD OCCUR. THE NCP REQUIRES THE DEVELOPMENT OF A NO ACTION ALTERNATIVE AS A BASIS FOR THE COMPARISON OF ALTERNATIVES. THIS ALTERNATIVE WOULD INCLUDE MAINTENANCE OF THE EXISTING ALTERNATIVE WATER SUPPLY TO THE FOUR AFFECTED RESIDENCES AND LONG-TERM MONITORING.

SINCE NO REMEDIAL ACTION IS TAKEN, THERE WOULD BE NO ADDITIONAL RISKS POSED TO THE COMMUNITY. HOWEVER, IT IS ESTIMATED THAT THE GROUNDWATER BETWEEN THE SITE AND FISHING CREEK WOULD REMAIN CONTAMINATED ABOVE MCLS FOR GREATER THAN 50 YEARS. THIS ALTERNATIVE PROVIDES NO REDUCTION IN THE TOXICITY, MOBILITY, OR VOLUME OF CONTAMINANTS THROUGH TREATMENT, THEREFORE, THE POTENTIAL FUTURE RISK OF EXPOSURE TO OFF-SITE CONTAMINATED GROUNDWATER REMAINS.

5.0.2 ALTERNATIVE 2 - ALTERNATIVE WATER SUPPLY AND INSTITUTIONAL CONTROLS

ALTERNATIVE 2 WILL RESULT IN THE CONSTRUCTION OF A NEW WATER SUPPLY LINE TO REPLACE THE EXISTING LINE SERVING THE RESIDENTS ADJACENT TO THE SITE. AS PART OF THIS ALTERNATIVE, INSTITUTIONAL CONTROLS (DEED RESTRICTIONS) WILL BE PLACED ON ALL ADJACENT PROPERTIES.

SINCE THIS ALTERNATIVE DOES NOT REQUIRE REMEDIAL ACTIVITIES FOR THE GROUNDWATER, THERE ARE NO SHORT TERM IMPACTS ASSOCIATED WITH THIS ALTERNATIVE. AS WITH ALTERNATIVE 1, THIS REMEDIAL ALTERNATIVE DOES NOT DIRECTLY ADDRESS THE CONTAMINATED GROUNDWATER BELOW THE SITE. CONSEQUENTLY, THE RESIDUAL RISK WILL REMAIN UNCHANGED AS THERE IS NO REDUCTION IN TOXICITY, MOBILITY OR VOLUME.

THE INSTITUTIONAL CONTROLS MAY BE EFFECTIVE FOR NEW RESIDENTIAL DEVELOPMENTS DUE TO THE PUBLIC TENDENCY TO AVOID THE USE OF IDENTIFIED CONTAMINATED WATER. THIS, HOWEVER, MAY NOT BE THE CASE WHERE A RESIDENCE IS CONSTRUCTED AWAY FROM THE SUPPLY LINE AND THE COST TO THE PROPERTY OWNER OF CONNECTING TO AND USING THE SUPPLIED WATER IS GREATER THAN THE COST OF INSTALLING A PRIVATE WELL.

THIS ALTERNATIVE IS CAPABLE OF PROTECTING HUMAN HEALTH IN THE SHORT-TERM DUE TO THE MEASURES WHICH ALLOW THE COMMUNITY TO AVOID THE USE OF THE CONTAMINATED GROUNDWATER. HOWEVER, SINCE THIS ALTERNATIVE DOES NOT DIRECTLY MITIGATE THE GROUNDWATER TRANSPORT PATHWAY AND/OR CONTAMINANT LEVELS, THE LONG TERM PROTECTION OF HUMAN HEALTH WILL BE LIMITED BY THE ABILITY TO ENFORCE THE INSTITUTIONAL CONTROLS. THE CONSTRUCTION ACTIVITIES FOR THIS ALTERNATIVE IS NOT EXPECTED TO POSE ANY ADDITIONAL RISK TO THE COMMUNITY.

5.0.3 ALTERNATIVE 3 - GROUNDWATER EXTRACTION AND DISCHARGE TO THE POTW

ALTERNATIVE 3 WILL CONSIST OF THE INSTALLATION OF A GROUNDWATER EXTRACTION SYSTEM FOR HYDRAULIC CONTAINMENT AND ACTIVE RESTORATION OF THE GROUNDWATER, AND THE CONSTRUCTION OF A FORCEMAIN TO THE LOCAL POTW COLLECTION SYSTEM. SPECIFIC REMEDIAL ACTIVITIES WILL INCLUDE:

- I) THE CONSTRUCTION OF ROUGH GRADE ACCESS ROADS TO THE EXTRACTION WELL LOCATIONS;
- II) THE INSTALLATION OF GROUNDWATER EXTRACTION WELLS;
- III) THE CONDUCTING OF PUMPING TESTS ON EACH EXTRACTION WELL;
- IV) THE CONSTRUCTION OF A PUMP STATION AT EACH EXTRACTION WELL;
- V) THE CONSTRUCTION OF FORCEMAINS TO CONVEY THE EXTRACTED GROUNDWATER TO THE POTW; AND

VI) LONG-TERM MONITORING.

DUE TO THE NATURE OF THE AQUIFER BENEATH THE SITE (FRACTURED BEDROCK), THE USE OF EXTRACTION WELLS IS THE ONLY FEASIBLE METHOD TO ACHIEVE HYDRAULIC CONTAINMENT.

THIS ALTERNATIVE WILL RESULT IN THE REMOVAL AND TREATMENT OF CONTAMINATED GROUNDWATER FROM BENEATH AND DOWNGRAIENT OF THE SITE. THEREFORE, THE ALTERNATIVE IS EFFECTIVE IN REDUCING THE POTENTIAL FUTURE RESIDUAL RISK ASSOCIATED WITH EXPOSURE TO CONTAMINATED GROUNDWATER. IT IS ESTIMATED THAT APPROXIMATELY 10 YEARS OF PUMPING ARE REQUIRED TO ACHIEVE THE CLEANUP GOALS ON SITE AND OFF SITE.

THIS ALTERNATIVE WILL RESULT IN THE REDUCTION OF TOXICITY, MOBILITY AND VOLUME OF CONTAMINANTS. SINCE THE EXTRACTED GROUNDWATER WILL BE DISCHARGED TO THE SANITARY SEWER, TREATMENT WILL OCCUR TO SOME DEGREE WITHIN THE WASTEWATER TREATMENT PLANT. THE MOBILITY OF THE CONTAMINANTS WITHIN THE GROUNDWATER TO FISHING CREEK IS EFFECTIVELY ELIMINATED BY HYDRAULIC CAPTURE AND THE VOLUME OF CONTAMINANTS IN THE GROUNDWATER IS REDUCED OVER THE LIFE OF THE REMEDY.

THIS ALTERNATIVE IS PROTECTIVE OF HUMAN HEALTH AND THE ENVIRONMENT THROUGH THE COLLECTION OF THE CONTAMINATED GROUNDWATER AND TREATMENT OF THE GROUNDWATER IN THE LOCAL POTW. THIS ALTERNATIVE ALSO PREVENTS THE CONTINUED MIGRATION OF GROUNDWATER TO FISHING CREEK.

5.0.4 ALTERNATIVE 4 - GROUNDWATER EXTRACTION WITH AERATION TREATMENT AND DISCHARGE TO FISHING CREEK

ALTERNATIVE 4 CONSISTS OF GROUNDWATER EXTRACTION WITH TREATMENT OF THE EXTRACTED GROUNDWATER FOLLOWED BY DISCHARGE TO FISHING CREEK. THIS ALTERNATIVE UTILIZES THE SAME EXTRACTION SYSTEM COMPONENTS PREVIOUSLY DESCRIBED FOR ALTERNATIVE 3. HOWEVER, INSTEAD OF DISCHARGING DIRECTLY TO THE POTW SYSTEM, THE EXTRACTED GROUNDWATER IS TREATED ON-SITE USING AN AERATION SYSTEM, THEN DISCHARGED TO THE ADJACENT SURFACE WATER VIA A NPDES PERMIT.

AS DISCUSSED FOR ALTERNATIVE 3, THE EXTRACTION SYSTEM WILL SIGNIFICANTLY REDUCE THE ENVIRONMENTAL MOBILITY AND VOLUME OF CONTAMINANTS IN THE GROUNDWATER. THE TREATMENT TECHNOLOGY USED IN THIS ALTERNATIVE DOES NOT DIRECTLY RESULT IN THE REDUCTION OF TOXICITY, MOBILITY, OR VOLUME OF CONTAMINANTS THROUGH TREATMENT. INSTEAD, THE CONTAMINANTS ARE REMOVED FROM THE LIQUID MEDIUM AND TRANSFERRED TO THE GASEOUS MEDIUM. SOME DEGREE OF TREATMENT IS ACHIEVED SUBSEQUENTLY THROUGH NATURAL PROCESSES SUCH AS PHOTO-OXIDATION AND ENVIRONMENTAL BIODEGRADATION.

THIS ALTERNATIVE IS CONSIDERED TO BE PROTECTIVE OF HUMAN HEALTH AND THE ENVIRONMENT. THE ALTERNATIVE ADDRESSES BOTH THE PATHWAY OF CONCERN AND

THE CONTAMINANTS OF CONCERN.

5.0.5 ALTERNATIVE 5 - GROUNDWATER EXTRACTION WITH BIOLOGICAL
TREATMENT AND DISCHARGE TO FISHING CREEK

ALTERNATIVE 5 CONSISTS OF GROUNDWATER EXTRACTION WITH TREATMENT OF THE
EXTRACTED GROUNDWATER FOLLOWED BY DISCHARGE TO FISHING CREEK. THIS
ALTERNATIVE IS IDENTICAL TO ALTERNATIVE 4, WITH THE EXCEPTION OF THE
TREATMENT TECHNOLOGY WHICH IS UTILIZED. TREATMENT OF THE EXTRACTED
GROUNDWATER CONSISTS OF BIOLOGICAL TREATMENT USING AN
AEROBIC/FACULTATIVE LAGOON.

AS DISCUSSED FOR ALTERNATIVE 3, THE EXTRATION SYSTEM WILL SIGNIFICANTLY
REDUCE THE ENVIRONMENTAL MOBILITY AND VOLUME OF CONTAMINANTS IN THE
GROUNDWATER. THE TREATMENT TECHNOLOGY USED IN THIS ALTERNATIVE WILL
RESULT IN THE DIRECT REDUCTION OF TOXICITY, MOBILITY, OR VOLUME OF
CONTAMINANTS THROUGH BIOLOGICAL TREATMENT. SOME ADDITIONAL DEGREE OF
TREATMENT IS ALSO ACHIEVED IN THE LAGOON THROUGH NATURAL PROCESSES SUCH
AS PHOTO-OXIDATION AND EVAPORATION.

THIS ALTERNATIVE IS CONSIDERED TO BE PROTECTIVE OF HUMAN HEALTH AND THE
ENVIRONMENT. THE ALTERNATIVE ADDRESSES BOTH THE PATHWAY OF CONCERN AND
THE CONTAMINANTS OF CONCERN.

5.1 NINE POINT EVALUATION CRITERIA FOR EVALUATING REMEDIAL ACTION
ALTERATIVES

THE FIVE REMEDIAL ALTERNATIVES WERE INDIVIDUALLY EVALUATED TO DETERMINE
WHICH ALTERNATIVE PROVIDES THE "BEST BALANCE" OF TRADEOFFS WITH RESPECT
TO THE FOLLOWING EVALUATION CRITERIA:

THRESHOLD CRITERIA	I)	OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT; AND
	II)	COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS.
PRIMARY BALANCING CRITERIA	III)	LONG-TERM EFFECTIVENESS AND PERMANENCE;
	IV)	REDUCTION OF TOXICITY, MOBILITY, OR VOLUME;
	V)	SHORT TERM EFFECTIVENESS;
	VI)	IMPLEMENTABILITY; AND
	VII)	COSTS.
MODIFYING CRITERIA	VIII)	STATE/SUPPORT AGENCY ACCEPTANCE; AND
	IX)	COMMUNITY ACCEPTANCE.

BASED ON THE INDIVIDUAL EVALUATIONS, THE REMEDIAL ALTERNATIVES WERE

SUBSEQUENTLY COMPARED FOR THEIR RELATIVE PERFORMANCE AGAINST THE EVALUATION CRITERIA. THE TWO MODIFYING CRITERIA WHICH COULD NOT BE EVALUATED IN THE FEASIBILITY STUDY ARE INCLUDED BELOW.

BASED ON THE STATUTORY LANGUAGE AND CURRENT US EPA GUIDANCE, THE NINE CRITERIA USED TO EVALUATE THE REMEDIAL ALTERNATIVES LISTED ABOVE WERE:

1. OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT ADDRESSES WHETHER OR NOT THE REMEDY PROVIDES ADEQUATE PROTECTION AND DESCRIBES HOW RISKS ARE ELIMINATED, REDUCED OR CONTROLLED THROUGH TREATMENT, ENGINEERING CONTROLS, OR INSTITUTIONAL CONTROLS.
2. COMPLIANCE WITH ARARS ADDRESSES WHETHER OR NOT THE REMEDY WILL MEET ALL OF THE APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS OF OTHER ENVIRONMENTAL STATUTES AND/OR PROVIDE GROUNDS FOR INVOKING A WAIVER.
3. LONG-TERM EFFECTIVENESS AND PERMANENCE REFERS TO THE ABILITY OF A REMEDY TO MAINTAIN RELIABLE PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT OVER TIME ONCE CLEANUP GOALS HAVE BEEN MET.
4. REDUCTION OF TOXICITY, MOBILITY, OR VOLUME IS THE ANTICIPATED PERFORMANCE OF THE TREATMENT TECHNOLOGIES A REMEDY MAY EMPLOY.
5. SHORT-TERM EFFECTIVENESS INVOLVES THE PERIOD OF TIME NEEDED TO ACHIEVE PROTECTION AND ANY ADVERSE IMPACTS ON HUMAN HEALTH AND THE ENVIRONMENT THAT MAY BE POSED DURING THE CONSTRUCTION AND IMPLEMENTATION PERIODS UNTIL CLEANUP GOALS ARE ACHIEVED.
6. IMPLEMENTABILITY IS THE TECHNICAL AND ADMINISTRATIVE FEASIBILITY OF A REMEDY INCLUDING THE AVAILABILITY OF GOODS AND SERVICES NEEDED TO IMPLEMENT THE CHOSEN SOLUTION.
7. COST INCLUDES CAPITAL AND OPERATION AND MAINTENANCE COSTS.
8. SUPPORT AGENCY ACCEPTANCE INDICATES WHETHER, BASED ON ITS REVIEW OF THE RI/FS AND PROPOSED PLAN, THE SUPPORT AGENCY (IDEM) CONCURS, OPPOSES, OR HAS NO COMMENT ON THE PREFERRED ALTERNATIVE.
9. COMMUNITY ACCEPTANCE INDICATES THE PUBLIC SUPPORT OF A GIVEN REMEDY. THIS CRITERIA IS DISCUSSED IN THE RESPONSIVENESS SUMMARY.

TABLE 27 SUMMARIZES THE FACTORS THAT ARE CONSIDERED UNDER EACH OF THE NINE EVALUATION CRITERIA.

5.1.1.1 OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

ALL OF THE ALTERNATIVES, WITH THE EXCEPTION OF THE NO ACTION ALTERNATIVE, WOULD PROVIDE ADEQUATE PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT BY ELIMINATING, REDUCING, OR CONTROLLING RISK FROM THE

ENVIRONMENT THROUGH TREATMENT, ENGINEERING CONTROLS OR INSTITUTIONAL CONTROLS. AS THE NO ACTION ALTERNATIVE (ALTERNATIVE 1) DOES NOT SATISFY THE REMEDIAL ACTION GOAL TO PROVIDE ADEQUATE PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT, IT IS NOT ELIGIBLE FOR SELECTION. ALTHOUGH ALTERNATIVE 2 WOULD BE PROTECTIVE OF HUMAN HEALTH, THE DEGREE OF PROTECTION IS DEPENDENT ON THE ABILITY TO ENFORCE THE IDENTIFIED INSTITUTIONAL CONTROLS. ALTERNATIVE 2 IS ELIMINATED FROM FURTHER CONSIDERATION FOR THE FOLLOWING TWO FACTORS: THIS ALTERNATIVE DOES NOT ADDRESS THE REMEDIATION OF GROUNDWATER, RESULTING IN THE CONTINUING RESIDUAL RISK OF CONTAMINATION OF THE GROUNDWATER REMAINING UNCHANGED AND SECONDLY, THE LIMITED ABILITY OF EPA, THE STATE OR THE LOCAL GOVERNMENT TO STRICTLY ENFORCE THE INSTITUTIONAL CONTROLS AT THE SITE.

ALTERNATIVES 3, 4, AND 5 ADDRESS THE RESIDUAL RISK ASSOCIATED WITH GROUNDWATER IN TERMS OF MITIGATING BOTH THE TRANSPORT PATHWAY AND CONTAMINANT LEVELS. CONSEQUENTLY, THEY ARE DEEMED TO PROVIDE THE BEST OVERALL PROTECTION TO HUMAN HEALTH AND THE ENVIRONMENT. DUE TO THE POTENTIAL FOR MINIMAL AIR EMISSIONS FROM ALTERNATIVE 4, THIS ALTERNATIVE IS DEEMED TO BE marginally LESS PROTECTIVE THAN THE OTHER TWO TREATMENT ALTERNATIVES DURING THE PERIOD OF IMPLEMENTATION.

THE OVERALL LEVEL OF PROTECTION REDUCES ACCORDINGLY WITH ALTERNATIVE 2 AND ALTERNATIVE 1 DUE TO CONCERNS OVER THE ADEQUACY OF THE INSTITUTIONAL CONTROLS AND THE FAILURE TO ADDRESS THE GROUNDWATER TRANSPORT PATHWAY AND CONTAMINANT LEVELS.

5.1.2 COMPLIANCE WITH ARARS

THE ARARS WHICH WERE DETERMINED TO BE APPLICABLE TO THE REMEDIAL ALTERNATIVES INCLUDED MCLS FOR THE GROUNDWATER, SURFACE WATER CRITERIA FOR DISCHARGES TO FISHING CREEK AND PRETREATMENT REQUIREMENTS FOR THE POTW.

ALTERNATIVES 1 AND 2 WILL NOT ACHIEVE MCLS FOR AT LEAST 50 YEARS WHEREAS ALTERNATIVES 3, 4 AND 5 ARE EXPECTED TO ACHIEVE MCLS WITHIN TEN YEARS.

ALTERNATIVES 4 AND 5 WILL ACHIEVE APPROXIMATELY THE SAME LEVEL OF COMPLIANCE WITH THE SURFACE WATER ARARS. MINOR EXCEEDANCES OF THE HEALTH-BASED CRITERIA WILL OCCUR UNDER THE 7Q10 FLOW CONDITION, HOWEVER, THESE ARE DEEMED TO BE NOT SIGNIFICANT.

COMPLIANCE WITH THE POTW PRETREATMENT REQUIREMENTS FOR ALTERNATIVE WAS NOT ASSESSED AND IS NOT EXPECTED TO BE MAJOR HURDLE.

5.1.3 LONG-TERM EFFECTIVENESS AND PERMANENCE

ALTERNATIVES 3, 4 AND 5 WILL RESULT IN LONG-TERM EFFECTIVE REMEDIES WHICH WILL REDUCE THE MAGNITUDE OF THE RESIDUAL RISK ASSOCIATED WITH THE CONTAMINATED GROUNDWATER. SINCE THESE THREE ALTERNATIVES UTILIZE THE SAME GROUNDWATER EXTRACTION COMPONENT, THEY ARE DEEMED TO BE EQUIVALENT

IN TERMS OF LONG-TERM EFFECTIVENESS AND PERMANENCE.

ALTERNATIVES 1 AND 2 DO NOT DIRECTLY ADDRESS THE CONTAMINATED GROUNDWATER; CONSEQUENTLY THEY ARE DEEMED TO BE LESS EFFECTIVE IN THE LONG-TERM THAN THE OTHER ALTERNATIVES.

5.1.4 REDUCTION OF TOXICITY, MOBILITY, OR VOLUME

THE GREATEST DEGREE OF REDUCTION OF TOXICITY, MOBILITY, OR VOLUME OF CONTAMINANTS IS ACHIEVED BY ALTERNATIVES 3 AND 5, FOLLOWED BY ALTERNATIVE 4. ALL THREE OF THESE ALTERNATIVES WILL REDUCE THE MOBILITY AND VOLUME OF CONTAMINANTS WITHIN THE GROUNDWATER FLOW SYSTEM TO THE SAME EXTENT. HOWEVER, ALTERNATIVES 3 AND 5 UTILIZE BIOLOGICAL TREATMENT TO REDUCE THE TOXICITY OF EXTRACTED CONTAMINANTS WHEREAS ALTERNATIVE 4 INDIRECTLY ACHIEVES A REDUCTION IN TOXICITY. ALTERNATIVE 4 WHICH EMPLOYS AIR STRIPPING, RESULTS IN THE TRANSFER OF CONTAMINANTS FROM THE GROUNDWATER TO THE ATMOSPHERE. CONSEQUENTLY, ALTERNATIVE 4 IS DEEMED TO BE LESS EFFECTIVE FOR THIS EVALUATION FACTOR.

ALTERNATIVES 1 AND 2 DO NOT REQUIRE EXTRACTION AND TREATMENT OF CONTAMINATED GROUNDWATER; THEREFORE THESE ALTERNATIVES DO NOT ADDRESS THIS EVALUATION FACTOR.

5.1.5 SHORT-TERM EFFECTIVENESS

THE DEGREE OF SHORT-TERM EFFECTIVENESS ACHIEVED BY THE ALTERNATIVES WHICH INVOLVE REMEDIAL ACTION ON THE GROUNDWATER IS ESSENTIALLY THE SAME FOR ALTERNATIVES 3, 4 AND 5 DUE TO THE IDENTICAL GROUNDWATER REMEDIAL COMPONENT FOR EACH ALTERNATIVE. OF THESE THREE ALTERNATIVES, ALTERNATIVES 4 AND 5 WILL HAVE GREATER POTENTIAL FOR ENVIRONMENTAL IMPACTS, HOWEVER, THE ESTIMATED IN STREAM CONCENTRATIONS FOR THESE TWO ALTERNATIVES INDICATE THAT THIS IMPACT IS NEGLIGIBLE. ALTERNATIVE 4 WILL RESULT IN INCREASED AIR EMISSIONS COMPARED TO ALTERNATIVE 5, HOWEVER, THE IMPACT IS NOT DEEMED TO BE SIGNIFICANT.

ALTERNATIVES 1 AND 2 DO NOT DIRECTLY ADDRESS THE CONTAMINATED GROUNDWATER; CONSEQUENTLY, THEY ARE DEEMED TO BE LESS EFFECTIVE IN THE SHORT-TERM THAN THE OTHER THREE ALTERNATIVES.

5.1.6 IMPLEMENTABILITY

THERE ARE NO MAJOR FORESEEABLE IMPLEMENTABILITY CONCERNS FOR ANY OF THE REMEDIAL ALTERNATIVES. THE TECHNOLOGIES USED FOR THESE ALTERNATIVES RELY ON STANDARDIZED CONSTRUCTION METHODS AND DEMONSTRATED TECHNOLOGIES. FOR THE TREATMENT ALTERNATIVES, THE ADMINISTRATIVE CONCERNS INCLUDE THE EASE OF OBTAINING NPDES PERMITS FOR ALTERNATIVES 4 AND 5, AND THE CAPABILITIES AND CAPACITY OF THE POTW FOR ALTERNATIVE 3. BASED ON THE TYPE AND CONCENTRATIONS OF CONTAMINANTS OF CONCERN, THESE CONCERNS ARE NOT DEEMED TO BE SUFFICIENTLY SIGNIFICANT TO ELIMINATE ANY OF THE TREATMENT ALTERNATIVES FROM FURTHER CONSIDERATION.

5.1.7 COST

THE COSTS ASSOCIATED WITH IMPLEMENTATION OF THE REMEDIAL ALTERNATIVES ARE LOWEST FOR THE "NO ACTION" ALTERNATIVE AND INCREASE SUCCESSIVELY FOR ALTERNATIVES 2, 4, 5, AND 3. SINCE ALTERNATIVE 1 DOES NOT INVOLVE CAPITAL CONSTRUCTION, THE TOTAL PRESENT WORTH FOR THIS ALTERNATIVE IS ATTRIBUTABLE TO LONG-TERM MONITORING AND MAINTENANCE COSTS ONLY. THE TOTAL COSTS FOR THE OTHER ALTERNATIVES CONSISTS OF CAPITAL AND OPERATION AND MAINTENANCE COSTS.

FOR THOSE ALTERNATIVES INVOLVING CAPITAL CONSTRUCTION, THE CAPITAL COST ESTIMATES RANGE FROM \$243,750 FOR ALTERNATIVE 2 TO \$802,670 FOR ALTERNATIVE 3. THE LONG-TERM OPERATION AND MAINTENANCE COSTS RANGE FROM \$331,914 FOR ALTERNATIVES 1 AND 2 TO \$645,833 FOR ALTERNATIVE 5. FOR THOSE ALTERNATIVES WHICH CONSIST OF BOTH CAPITAL AND OPERATION AND MAINTENANCE COSTS, THE OPERATION AND MAINTENANCE COST COMPONENTS ARE SIGNIFICANT, BEING OF THE SAME ORDER OF MAGNITUDE AS THE CAPITAL COSTS.

THE TOTAL PRESENT WORTH OF THE ALTERNATIVES VARY FROM A LOW OF \$331,914 TO A HIGH OF \$1,365,305. IN INCREASING ORDER OF TOTAL COSTS, THE ALTERNATIVES ARE ALTERNATIVE 1, ALTERNATIVE 2, ALTERNATIVE 4, ALTERNATIVE 5, AND ALTERNATIVE 3. THE TOTAL COSTS FOR THE TREATMENT ALTERNATIVES ARE ALL WITHIN THE SAME MAGNITUDE WHEREAS THE TOTAL COSTS FOR THE OTHER TWO ALTERNATIVES ARE ONLY A FRACTION THEREOF.

TABLE 28 PROVIDES A COMPARISON OF COSTS FOR EACH ALTERNATIVE EVALUATED OVER A 10 YEAR PERIOD AND A 30 YEAR PERIOD.

5.1.8 STATE ACCEPTANCE

THE STATE OF SOUTH OF CAROLINA CONCURS WITH THE SELECTED REMEDIAL ALTERNATIVE.

5.1.9 COMMUNITY ACCEPTANCE

THE DRAFT RI AND FS DOCUMENTS ALONG WITH THE PROPOSED PLAN FOR THE CAROLAWN SITE WERE RELEASED TO THE PUBLIC IN AUGUST 1989. THESE THREE DOCUMENTS WERE MADE AVAILABLE TO THE PUBLIC IN THE ADMINISTRATIVE RECORD FILE AND AN INFORMATION REPOSITORY MAINTAINED AT THE EPA DOCKET ROOM IN REGION IV AND AT THE LANCASTER COUNTY PUBLIC LIBRARY. THE NOTICE OF THE PUBLIC MEETING AND THE AVAILABILITY FOR THESE TWO DOCUMENTS AND THE ADMINISTRATIVE RECORD WAS PUBLISHED IN THE LANCASTER NEWS ON AUGUST 25, 1989 AND THE CHESTER NEWS AND REPORTER ON AUGUST 28, 1989. A PUBLIC COMMENT PERIOD WAS HELD FROM AUGUST 28, 1989 THROUGH SEPTEMBER 22, 1989. IN ADDITION, A PUBLIC MEETING WAS HELD AT LANCASTER COUNTY PUBLIC LIBRARY MEETING ROOM ON AUGUST 30, 1989. AT THIS MEETING, REPRESENTATIVES FROM EPA AND THE SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL ANSWERED QUESTIONS ABOUT PROBLEMS AT THE SITE AND THE REMEDIAL ALTERNATIVES UNDER CONSIDERATION. A RESPONSE TO THE

COMMENTS RECEIVED DURING THIS PERIOD IS INCLUDED IN THE RESPONSIVENESS SUMMARY, WHICH IS PART OF THIS ROD. THE RESPONSIVENESS SUMMARY ALSO ASSESSES THE COMMUNITY ACCEPTANCE OF THE AGENCY'S PROPOSAL. THIS DECISION DOCUMENT PRESENTS THE SELECTED REMEDIAL ACTION FOR THE CAROLAWN SITE, IN FORT LAWN, SOUTH CAROLINA, CHOSEN IN ACCORDANCE WITH CERCLA, AS AMENDED BY SARA, AND TO THE EXTENT PRACTICABLE, THE NATIONAL CONTINGENCY PLAN. THIS DECISION, FOR THIS SITE, IS BASED ON THE CAROLAWN ADMINISTRATIVE RECORD FILE.

#RA

6.0 RECOMMENDED ALTERNATIVE

TABLE 29 FURNISHES A SUMMARY OF THE DETAILED ANALYSIS ON THE REMEDIAL ALTERNATIVES CONSIDERED FOR THE CAROLAWN SUPERFUND SITE.

6.1 DESCRIPTION OF RECOMMENDED REMEDY

MIGRATION CONTROL (REMEDIATION OF CONTAMINATED GROUNDWATER)

INSTALLATION OF A GROUNDWATER INTERCEPTION AND EXTRACTION SYSTEM AT THE SITE. THE LEVEL AND DEGREE OF TREATMENT OF THE EXTRACTED GROUNDWATER WILL DEPEND ON 1) THE ULTIMATE DISCHARGE POINT OF THIS WATER AND 2) THE LEVEL OF CONTAMINANTS IN THE EXTRACTED GROUNDWATER. THREE WATER DISCHARGE ALTERNATIVES FOR THE TREATED GROUNDWATER ARE 1) THE LOCAL SEWER SYSTEM, (I.E., PUBLICLY OWNED TREATMENT WORKS), 2) FISHING CREEK VIA A NATIONAL POLLUTION DISCHARGE ELIMINATION SYSTEM PERMIT OR, 3) ON-SITE IRRIGATION. A FOURTH DISCHARGE POSSIBILITY IS GROUNDWATER INJECTION. THE RANGE OF TREATMENT FOR THE EXTRACTED GROUNDWATER INCLUDES AIR STRIPPING, BIODEGRADATION, FILTRATION THROUGH ACTIVATED CARBON FILTER AND METAL REMOVAL. THE MOST COST EFFECTIVE COMBINATION FOR THE POINT OF DISCHARGE AND THE DEGREE OF TREATMENT WILL BE DETERMINED IN THE REMEDIAL DESIGN STAGE. THE DISCHARGED WATER WILL MEET ALL ARAR'S. CONCURRENCE ON THE FINAL DESIGN WILL BE REQUESTED FROM THE STATE OF SOUTH CAROLINA. COMMENTS WILL ALSO BE SOLICITED FROM THE PUBLIC ON THE FINAL DESIGN.

REVIEW THE EXISTING GROUNDWATER MONITORING SYSTEM TO INSURE PROPER MONITORING OF GROUNDWATER. IF DEEMED NECESSARY, ADDITIONAL MONITOR WELLS WILL BE INSTALLED TO MITIGATE ANY DEFICIENCIES IN THE EXISTING GROUNDWATER MONITORING SYSTEM.

APPROPRIATE INSTITUTIONAL CONTROLS (DEED RESTRICTIONS) WILL BE IMPLEMENTED.

UPON THE CONDEMNATION OF THE ADJACENT CONTAMINATED PRIVATE, POTABLE WELLS BY THE COUNTY OF CHESTER, THESE WELLS WILL BE PLUGGED IN ACCORDANCE TO SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL REGULATIONS.

SOURCE CONTROL (REMEDIATION OF CONTAMINATED SOILS)

DUE TO THE EFFECTIVENESS OF THE REMOVAL ACTIONS, NO SOURCE OF CONTAMINATION REMAINS WITHIN THE FENCED AREA OF THE SITE. HOWEVER, ADDITIONAL FIELD WORK IS REQUIRED IN THE DISPOSAL AREA NORTH OF THE FENCED AREA. THIS FIELD WORK WILL CONSIST OF THE INSTALLATION OF CONFIRMATORY SOIL BORINGS TO VERIFY THE PRESENCE OR ABSENCE OF CONTAMINATION IN THIS AREA. IF NO CONTAMINATION IS FOUND, THERE WILL NO SOURCE CONTROL REMEDIATION REQUIRED AT THE CAROLAWN SITE, HOWEVER, IF CONTAMINATED SOIL IS FOUND, A SECOND RECORD OF DECISION WILL BE NECESSARY TO ADDRESS THIS SOURCE OF CONTAMINATION.

GENERAL SITE CLEANUP ACTIVITIES

THE TWO INACTIVE INCINERATORS WILL BE INSPECTED AND ANY REMAINING RESIDUE WILL BE SAMPLED AND ANALYZED. ALSO, WIPE SAMPLES WILL BE COLLECTED AND ANALYZED. THE RESULTS OF THE ANALYSES WILL DETERMINE THE METHOD OF DISPOSITION FOR THE INCINERATORS. THE TWO REMAINING DRUMS WILL ALSO BE SAMPLED AND ANALYZED TO DETERMINE HOW THEY WILL BE DISPOSED. IN ADDITION, SITE CLEANUP WILL INCLUDE CLOSING OF THE EQUIPMENT DECONTAMINATION AREA USED DURING PHASE I RI ACTIVITIES.

6.2 OPERATIONS AND MAINTENANCE

LONG TERM OPERATION AND MAINTENANCE (O&M) WILL CONCENTRATE ON THE GROUNDWATER EXTRACTION, WATER TREATMENT AND GROUNDWATER MONITORING SYSTEMS.

6.3 COST OF RECOMMENDED ALTERNATIVE

THE ESTIMATED PRESENT WORTH COST FOR EXTRACTING AND TREATING GROUNDWATER RANGES FROM \$1,141,071 TO \$1,356,305 MILLION, DEPENDING ON THE EXTENT OF TREATMENT AND ULTIMATE DISCHARGE POINT FOR THE TREATED WATER. THE CAPITAL COSTS AND PRESENT WORTH O&M COSTS OVER 30 YEARS RANGE FROM \$121,369 TO \$802,669 DOLLARS AND \$753,433 TO \$916,723, RESPECTIVELY.

6.4 SCHEDULE

THE PLANNED SCHEDULE FOR REMEDIAL ACTIVITIES AT THE CAPE FEAR SITE IS AS FOLLOWS:

SEPTEMBER 1989	--	APPROVE RECORD OF DECISION
OCTOBER 1989	--	ISSUE RD/RA NOTICE LETTERS AND INITIATE RD/RA MORATORIUM PERIOD
MARCH 1990	--	INITIATE REMEDIAL DESIGN/TREATABILITY STUDY
MAY 1990	--	COMPLETE TREATABILITY STUDIES
AUGUST 1990	--	INITIATE REMEDIAL ACTION FOR ADDRESSING CONTAMINATED GROUNDWATER AND OTHER SPECIFIC CLEANUP ACTIVITIES

6.5 FUTURE ACTIONS

DUE TO THE LIMITED ANALYTICAL SOIL DATA COLLECTED FROM THE STORAGE AREA NORTH OF THE FENCED AREA, ADDITIONAL CONFIRMATORY SAMPLING WILL BE CONDUCTED IN THIS AREA TO CONFIRM THE PRESENCE OR ABSENCE OF RESIDUAL SOIL CONTAMINATION.

THE ONLY ANTICIPATED LONG-TERM ACTION EXPECTED TO BE CONDUCTED AT THE SITE FOLLOWING COMPLETION OF THE REMEDIAL ACTION IS PERIODIC MONITORING OF GROUNDWATER TO INSURE REMEDIATED LEVELS OBTAINED DURING THE REMEDIATION ARE MAINTAINED.

6.6 CONSISTENT WITH OTHER ENVIRONMENTAL LAWS

A REMEDIAL ACTION PERFORMED UNDER CERCLA MUST COMPLY WITH ALL APPLICABLE FEDERAL, STATE AND LOCAL REGULATIONS. ALL ALTERNATIVES CONSIDERED FOR THE CAROLAWN SITE WERE EVALUATED ON THE BASIS OF THE DEGREE TO WHICH THEY COMPLIED WITH THESE REGULATIONS. TABLE 30 LISTS THE IDENTIFIED ARARS FOR THE CAROLAWN SITE. THE RECOMMENDED ALTERNATIVE MEETS OR EXCEEDS ALL APPLICABLE ENVIRONMENTAL LAWS.

#CR

7.0 COMMUNITY RELATIONS

THE PROPOSED PLAN FACT SHEETS WAS TRANSMITTED TO INTERESTED PARTIES, RESIDENTS, MEDIA AND LOCAL, STATE AND FEDERAL OFFICIALS ON AUGUST 23, 1989. THE AGENCY ALSO CONDUCTED THE FS PUBLIC MEETING.

THE INFORMATION REPOSITORY/ADMINISTRATIVE RECORD WAS ESTABLISHED AT LANCASTER COUNTY PUBLIC LIBRARY LOCATED AT 313 SOUTH WHITE STREET IN LANCASTER, SOUTH CAROLINA.

A PUBLIC MEETING WAS HELD ON AUGUST 30, 1989, AT THE LANCASTER COUNTY PUBLIC LIBRARY IN LANCASTER, SOUTH CAROLINA. AT THIS MEETING, THE REMEDIAL ALTERNATIVES DEVELOPED IN THE FS WERE REVIEWED AND DISCUSSED AND EPA'S PREFERRED REMEDIAL ALTERNATIVE WAS DISSEMINATED. THE GROUNDWATER MITIGATION ALTERNATIVE WAS PRESENTED AS DESCRIBED IN SECTION 6.1 DESCRIPTION OF RECOMMENDED ALTERNATIVE. IN ADDITION TO DISCUSSING THE GROUNDWATER REMEDIATION ALTERNATIVE, ACTIVITIES TO CONFIRM THE ABSENCE OR PRESENCE OF SOIL CONTAMINATION IN THE STORAGE AREA NORTH OF THE FENCED AREA AS WELL AS GENERAL HOUSE CLEANING ACTIVITIES TO BE PERFORMED AT THE SITE WERE DISCUSSED.

THE PUBLIC COMMENT PERIOD CONCLUDED ON SEPTEMBER 22, 1989.

THE ONLY COMMENTS RECEIVED DURING THE PUBLIC COMMENT PERIOD WERE THOSE AIRED AND RESPONDED TO AT THE PUBLIC MEETING. THE RESPONSIVENESS SUMMARY SUMMARIZES THE COMMENTS STATED IN THE PUBLIC MEETING.

#SI
8.0 STATE INVOLVEMENT

THE STATE INVOLVEMENT HAS BEEN MAINTAINED THROUGHOUT THIS LENGTHY RI/FS PROCESS WITH REVIEWING PERTINENT DOCUMENTS SUCH AS THE DRAFT REMEDIAL INVESTIGATION REPORT, THE DRAFT FEASIBILITY STUDY, THE DRAFT RECORD OF DECISION AND HAVE BEEN CARBON COPIED ALL RELEVANT CORRESPONDENCES.

THE STATE OF SOUTH CAROLINA SUPPORTS THE ALTERNATIVE STATED IN THE DECLARATION AND SECTION 6.0.

#TA

RESPONSIVENESS SUMMARY

THIS COMMUNITY RESPONSIVENESS SUMMARY IS DIVIDED INTO THE FOLLOWING SECTIONS:

- SECTION I. OVERVIEW. THIS SECTION DISCUSSES EPA'S PREFERRED REMEDIAL ACTION ALTERNATIVE AND PUBLIC REACTION TO THIS ALTERNATIVE.
- SECTION II. BACKGROUND ON COMMUNITY INVOLVEMENT AND CONCERNS. THIS SECTION PROVIDES A BRIEF HISTORY OF COMMUNITY INTEREST AND CONCERNS RAISED DURING REMEDIAL PLANNING ACTIVITIES AT THE CAROLAWN SITE.
- SECTION III. SUMMARY OF MAJOR COMMENTS RECEIVED DURING THE PUBLIC MEETING AND THE PUBLIC COMMENT PERIOD AND EPA'S RESPONSES TO THESE COMMENTS. BOTH THE COMMENTS AND EPA'S RESPONSES ARE PROVIDED.
- SECTION IV. REMAINING CONCERNS. THIS SECTION DESCRIBES THE REMAINING COMMUNITY CONCERNS THAT EPA SHOULD BE AWARE OF IN CONDUCTING THE REMEDIAL DESIGN AND REMEDIAL ACTION AT THE CAROLAWN SITE.
- SECTION V. TRANSCRIPT OF THE PUBLIC MEETING. THIS SECTION PROVIDES A TRANSCRIPT OF THE REMEDIAL INVESTIGATION/FEASIBILITY STUDY PUBLIC MEETING HELD ON AUGUST 30, 1989 AT THE LANCASTER COUNTY PUBLIC LIBRARY LOCATED NEAR THE SITE.

SECTION I. OVERVIEW

THE PUBLIC MEETING AT WHICH EPA PRESENTED ITS PREFERRED ALTERNATIVE TO THE PUBLIC INITIATED THE PUBLIC COMMENT PERIOD WHICH ENDED ON SEPTEMBER

22, 1989. THE ALTERNATIVE ADDRESSES THE GROUNDWATER CONTAMINATION PROBLEM AT THE SITE. THE PREFERRED ALTERNATIVE SPECIFIED IN THE RECORD OF DECISION (ROD) INCLUDES: EXTRACTION AND PERMANENT TREATMENT OF CONTAMINATED GROUNDWATER, CONFIRMATION SOIL SAMPLING, AND GENERAL SITE "HOUSE CLEANING" ACTIVITIES.

IN THE PUBLIC MEETING, HELD AUGUST 30, 1989, FIVE REMEDIAL ALTERNATIVES WERE DESCRIBED TO THE PUBLIC FOR MIGRATION CONTROL. ONE OF THESE FIVE ALTERNATIVES WAS THEN PROPOSED TO THE PUBLIC AS EPA'S PREFERRED REMEDIAL ALTERNATIVE FOR THE CAROLAWN SITE. THE ACTUAL TREATMENT TRAIN TO BE INSTALLED TO TREAT THE EXTRACTED GROUNDWATER WILL BE DETERMINED DURING THE REMEDIAL DESIGN STAGE OF THE SUPERFUND PROCESS. THE DISCHARGE LOCATION OF THE TREATED GROUNDWATER WILL ALSO BE SELECTED DURING THE REMEDIAL DESIGN STAGE.

THE COMMUNITY, IN GENERAL, FAVORS REMEDIAL ACTION AT THE SITE.

SECTION II. BACKGROUND ON COMMUNITY INVOLVEMENT AND CONCERNS

THE CAROLAWN SITE IS AN ABANDONED WASTE STORAGE AND DISPOSAL FACILITY LOCATED NEAR FISHING CREEK AND SOUTH CAROLINA HIGHWAY 9, THREE MILES WEST OF FORT LAWN IN CHESTER COUNTY, SOUTH CAROLINA. THE 60-ACRE SITE IS SITUATED IN A RURAL SETTING BORDERED TO THE SOUTH BY THE LANCASTER/CHESTER RAILROAD TRACK AND TO THE NORTH BY A LARGE WOODED AREA. ONE-HALF MILE EAST OF THE SITE IS FISHING CREEK AND THE WEST IS BORDERED BY WOODLAND.

FIVE HOUSEHOLDS ARE LOCATED ADJACENT TO THE SITE. APPROXIMATELY 2,000 PEOPLE LIVE WITHIN A FOUR-MILE RADIUS OF THE SITE, WITH AN ESTIMATED 100 PEOPLE WITHIN A ONE-MILE RADIUS. FORT LAWN (POPULATION 471) IS LOCATED 2.5 MILES EAST OF THE SITE AND RICHBURG (POPULATION 269) IS LOCATED THREE (3) MILES WEST OF THE SITE. THE POPULATION ESTIMATIONS ARE BASED ON THE 1980 US CENSUS.

DUE TO THE RURAL NATURE OF THIS REGION AND THE SPARSE POPULATION, CONCERN OVER THE EVENTS AT THE CAROLAWN SITE HAVE BEEN LIMITED TO THE RESIDENTS LIVING NEAR THE SITE. SCDHEC RECEIVED ITS FIRST COMPLAINT ABOUT THE SITE IN 1972 WHEN CHEMICAL RECYCLING WAS BEING DONE ON-SITE. THE RESIDENCES MADE INFORMAL AND FORMAL COMPLAINTS TO SCDHEC, THE SOUTH CAROLINA POLLUTION CONTROL AUTHORITY, US EPA AND THE LOCAL MEDIA. THE LOCAL FAMILIES COMPLAINED TO LOCAL AND STATE AUTHORITIES ABOUT STRONG ORGANIC ODORS, FUMING DRUMS AND CHEMICAL VAPORS THAT REPORTEDLY COULD BE SEEN 1/2 MILE FROM THE SITE.

A PRIMARY CONCERN IN 1982 OF LOCAL RESIDENTS WAS THE CONTAMINATION OF THEIR DRINKING WATER. TO REMEDY THE SITUATION, A CITY WATER SUPPLY LINE WAS EXTENDED FROM CHESTER TO THE ADJACENT RESIDENCES IN 1985. THE ROCKHOLT AND HUNTER RESIDENCES HOOKED UP TO THE LINE BUT THE MORRISON HOME TURNED DOWN THE OFFER. THEIR DECISION WAS BASED ON A LETTER THEY RECEIVED FROM SCDHEC IN 1985/1986 STATING THAT THEIR POTABLE WELL WAS

CONTAMINANT FREE.

IN 1987, THE PRIMARY CONCERN OF AREA RESIDENTS IS THE QUESTION OF LAND VALUE. UNDERLYING THIS CONCERN IS THE CONFUSION OVER GROUNDWATER CONTAMINATION. ALL OF THE PARTIES WHO OWN PROPERTY NEAR THE SITE HAVE EXPRESSED AN INTEREST IN SELLING THEIR LAND BUT ALL HAD DOUBTS AS TO WHETHER THIS COULD BE DONE SUCCESSFULLY DUE TO THE CONDITION OF THE GROUNDWATER.

ANOTHER CHIEF INTEREST EXPRESSED BY AREA RESIDENTS IS THE MONITORING OF RESIDENTIAL WELLS. RESIDENTS WANT TO KNOW WHETHER THIS WILL BE AN ONGOING ACTIVITY OR WHETHER ALL INVESTIGATIONS ARE COMPLETE.

III. SUMMARY OF PUBLIC COMMENTS RECEIVED DURING THE PUBLIC MEETING AND THE PUBLIC COMMENT PERIOD AND AGENCY RESPONSES

COMMENTS RAISED DURING THE CAROLAWN PUBLIC MEETING AND PUBLIC COMMENT PERIOD ARE SUMMARIZED BRIEFLY BELOW. THE COMMENT PERIOD WAS OPEN FROM AUGUST 28 TO SEPTEMBER 22, 1989 TO RECEIVE COMMENTS FROM THE PUBLIC ON THE DRAFT FEASIBILITY STUDY AND PROPOSED REMEDIAL ALTERNATIVE.

THERE WAS A MODERATE RESPONSE FROM THE COMMUNITY IN THE PUBLIC MEETING BUT NO COMMENTS WERE RECEIVED DURING THE PURSUEING THE PUBLIC COMMENT PERIOD. SUMMARIES OF THE QUESTIONS RECEIVED DURING THE PUBLIC MEETING ARE PRESENTED BELOW. A COMPLETE RECORD OF QUESTIONS AND RESPONSES THAT TRANSPIRED DURING THE PUBLIC MEETING CAN BE FOUND IN SECTION V - TRANSCRIPT OF THE PUBLIC MEETING.

PUBLIC MEETING

THE PUBLIC MEETING WAS HELD ON AUGUST 30, 1989 AT THE LANCASTER COUNTY PUBLIC LIBRARY MEETING ROOM. QUESTIONS AND COMMENTS FELL INTO THE FOLLOWING CATEGORIES. THEY INCLUDED THE LACK OF INITIAL COMMUNICATION WITH THE PUBLIC PRIOR TO THE COMMENCEMENT OF AN ACTIVITY, THE PREFERENCE OF RESIDENTS FOR THEIR WELL WATER OVER CITY SUPPLIED WATER, THE START OF CLEAN UP ACTIVITIES, OTHER DISPOSAL AREAS WITH NO KNOWN ASSOCIATION WITH THE CAROLAWN SITE, THE LEVEL OF LEAD FOUND IN THE GROUNDWATER, THE IMPACT OF DISCHARGING TREATED GROUNDWATER TO FISHING CREEK, AND THE DURATION AND SAMPLING INTERVAL DURING LONG TERM MONITORING.

PUBLIC COMMENT PERIOD

NO COMMENTS WERE RECEIVED BY THE AGENCY DURING THE THREE WEEK COMMENT PERIOD THAT ENDED ON SEPTEMBER 22, 1989.

IV. REMAINING PUBLIC CONCERNS

IN ADDITION TO THOSE CONCERNS VOICED AT THE PUBLIC MEETING, SOME ADDITIONAL PUBLIC CONCERNS ARE DESCRIBED BELOW.

- * ADDITIONAL SAMPLING/ANALYSIS OF RESIDENTIAL WELLS FOR SITE RELATED CONTAMINANTS AND
- * LOCATION OF INFORMATION REPOSITORY/ADMINISTRATIVE RECORD AND FUTURE PUBLIC MEETINGS.

V. CAROLAWN REMEDIAL INVESTIGATION/FEASIBILITY STUDY PUBLIC MEETING

CAROLAWN PUBLIC MEETING
LANCASTER, SOUTH CAROLINA
30 AUGUST 1989
7:00 PM

TABLE 1

SUMMARY OF DETECTED COMPOUND-SURFACE SOIL SAMPLES
CAROLAWN SITE-FORT LAWN, SOUTH CAROLINA

PARAMETER	DETECTION	SAMPLE LOCATION		
	LIMIT (MG/KG)	CLSS-101A	CLSS-101B	CLSS-101C
METALS (TOTAL)				
ANTINOMY	0.05	U	U	U
ARSENIC	0.05	3.9	5.6	6.0
BARIUM	10.0	74	70	U
BERYLLIUM	0.20	U	U	U
CADMIUM	0.10	U	U	0.47
CHROMIUM	0.50	12	7.0	U
COPPER	1.0	34	11	U
LEAD	0.50	U	U	35
MERCURY	0.002	U	0.0055	0.0055
NICKEL	1.0	112	7.0	U
SELENIUM	0.10	U	U	U
SILVER	0.50	U	U	U
THALLIUM	0.50	U	U	U
ZINC	0.50	24	15	U

VOLATILES (UG/KG)

METHYLENE CHLORIDE	D	11 B	8.0 B	22 B
ACETONE		6.4 B	U	7.1 B

SEMI-VOLATILES
(UG/KG)

BIS(2-ETHYL HEXYL)				
PHTHALATE	D	2200	U	14000

NOTES:

SAMPLES WERE COMPOSITED FROM SAMPLES COLLECTED IN DESIGNATED AREAS.
 SAMPLES COLLECTED ON MAY 19-20, 1985. ANALYZED BY COMPUCHEM
 LABORATORIES.

- U - NOT DETECTED WITHIN MINIMUM, ATTAINABLE DETECTION LIMIT OF
 SAMPLE AS INDICATED.
- B - ANALYTE FOUND IN BLANK AS WELL AS SAMPLE. POSSIBLE/PROBABLE
 BLANK CONTAMINATION.
- D - DETECTION LIMIT VARIES.

TABLE 1 (CONTINUED)

SUMMARY OF DETECTED COMPOUND-SURFACE SOIL SAMPLES
 CAROLAWN SITE-FORT LAWN, SOUTH CAROLINA

PARAMETER	DETECTION	SAMPLE LOCATION		
	LIMIT (MG/KG)	CLSS-101A	CLSS-101B	CLSS-101C
METALS (TOTAL)				
ANTINOMY	0.05	U	U	U
ARSENIC	0.05	7.5	5.6	6.0
BARIUM	10.0	U	70	U
BERYLLIUM	0.20	U	U	U
CADMIUM	0.10	U	U	0.47
CHROMIUM	0.50	U	7.0	U
COPPER	1.0	U	11	U
LEAD	0.50	13	U	35
MERCURY	0.002	0.008	0.0055	0.0055
NICKEL	1.0	U	7.0	U
SELENIUM	0.10	U	U	U
SILVER	0.50	U	U	U
THALLIUM	0.50	U	U	U
ZINC	0.50	U	15	U
VOLATILES (UG/KG)				
METHYLENE CHLORIDE	D	19 B	51 B	12 B
ACETONE		U	21 B	6.2 B

SEMI-VOLATILES
(UG/KG)

BIS(2-ETHYL HEXYL)
PHTHALATE

D

790

55000

U

NOTES:

SAMPLES WERE COMPOSITED FROM SAMPLES COLLECTED IN DESIGNATED AREAS.
SAMPLES COLLECTED ON MAY 19-20, 1985. ANALYZED BY COMPUCEM
LABORATORIES.

- U - NOT DETECTED WITHIN MINIMUM, ATTAINABLE DETECTION LIMIT OF
SAMPLE AS INDICATED.
- B - ANALYTE FOUND IN BLANK AS WELL AS SAMPLE. POSSIBLE/PROBABLE
BLANK CONTAMINATION.
- D - DETECTION LIMIT VARIES.

TABLE 1

SUMMARY-SURFACE SOIL SAMPLING
WITHIN FENCED AREA (PHASE I)
CAROLAWN SITE
FORT LAWN, SOUTH CAROLINA

PARAMETER	DETECTION LIMIT (MG/KG)	MAXIMUM DETECTED (MG/KG)	MAXIMUM DETECTED (MG/KG)
METALS			
ANTINOMY	0.05	U	U
ARSENIC	0.05	7.5	3.9
BARIUM	10.0	74	70
BERYLLIUM	0.20	U	U
CADMIUM	0.10	0.47	U
CHROMIUM	0.50	12	7.0
COPPER	1.0	34	11
LEAD	0.50	35	13
MERCURY	0.002	0.008	0.0055
NICKEL	1.0	112	7.0
SELENIUM	0.10	U	U
SILVER	0.50	U	U
THALLIUM	0.50	U	U
ZINC	0.50	24	15

VOLATILES (UG/KG)

METHYLENE CHLORIDE	D	22 B	8.0 B
ACETONE	D	7.1 B	6.4 B

SEMI-VOLATILES (UG/KG)

BIS (2-ETHYLHEXYL) PHTHALATE	D	14,000	790
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NOTES:

SAMPLES WERE COMPOSITED FROM SAMPLES COLLECTED IN DESIGNATED AREAS.
 SAMPLES COLLECTED ON MAY 19-20, 1985. ANALYZED BY COMPUCHEM
 LABORATORIES.

- U - NOT DETECTED WITHIN MINIMUM, ATTAINABLE DETECTION LIMIT OF
 SAMPLE. DETECTION LIMIT AS INDICATED.
- B - ANALYTE FOUND IN BLANKS AS WELL AS SAMPLE. POSSIBLE/BLANK
 CONTAMINATION.
- C - DETECTION LIMIT VARIES.
- (1) - FOUR SOIL SAMPLE LOCATIONS; CLSS 101A TO CLSS 101D, AS SHOWN IN
 FIGURE 17. BASED ON TABLE 1.

TABLE 1 (CONTINUED)

SUMMARY-SURFACE SOIL SAMPLING
 WITHIN FENCED AREA (PHASE I)
 CAROLAWN SITE
 FORT LAWN, SOUTH CAROLINA

PARAMETER	NUMBER OF DETECTIONS ABOVE ANALYTICAL BACKGROUND (OF 4 SAMPLES)(1)	MEAN SOIL CONCENTRATIONS (MG/KG)
	ND = 0	ND = DL

METALS

ANTIMONY	0	0	0.05
ARSENIC	4	5.75	5.75
BARIUM	2	36	41
BERYLLIUM	0	0	0.20

CADMIUM	1	0.12	0.19
CHROMIUM	2	4.75	5.0
COPPER	2	11.25	11.75
LEAD	2	12	12.25
MERCURY	3	0.0051	0.0056
NICKEL	2	29.75	30.25
SELENIUM	0	0	0.1
SILVER	0	0	0.5
THALLIUM	0	0	0.5
ZINC	2	19.5	19.85

VOLATILES (UG/KG)

METHYLENE CHLORIDE	0	0	D
ACETONE	0	0	D

SEMI-VOLATILES (UG/KG)

BIS (2-ETHYLHEXYL) PHTHALATE	3	4247.5	D
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NOTES:

SAMPLES WERE COMPOSITED FROM SAMPLES COLLECTED IN DESIGNATED AREAS.
 SAMPLES COLLECTED ON MAY 19-20, 1985. ANALYZED BY COMPUCHEM
 LABORATORIES.

U - NOT DETECTED WITHIN MINIMUM, ATTAINABLE DETECTION LIMIT OF
 SAMPLE. DETECTION LIMIT AS INDICATED.
 B - ANALYTE FOUND IN BLANKS AS WELL AS SAMPLE. POSSIBLE/BLANK
 CONTAMINATION.
 C - DETECTION LIMIT VARIES.
 (1) - FOUR SOIL SAMPLE LOCATIONS; CLSS 101A TO CLSS 101D, AS SHOWN IN
 FIGURE 17. BASED ON TABLE 1.

TABLE 1 (CONTINUED)

SUMMARY-SUB-SURFACE SOIL SAMPLING
 WITHIN AND OUTSIDE FENCED AREA (PHASE I)
 CAROLAWN SITE
 FORT LAWN, SOUTH CAROLINA

PARAMETER	DETECTION LIMIT (MG/KG)	MAXIMUM DETECTED (MG/KG)	MAXIMUM DETECTED (MG/KG)
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METALS

ARSENIC	0.25	29	7.9
CHROMIUM	1.50	28	3.0
COPPER	1.0	100	10
CYANIDE	1.0	U	U
LEAD	0.25	7.0	1.6

VOLATILES (UG/KG)

METHYLENE CHLORIDE	10	10	U
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SEMI-VOLATILES (UG/KG)

BIS (2-ETHYLHEXYL) PHTHALATE	330	330	U
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NOTES:

SAMPLES COLLECTED ON JUNE 5-12, 1985. ANALYZED BY COMPUCHEM LABORATORIES.

U - NOT DETECTED WITHIN MINIMUM, ATTAINABLE DETECTION LIMIT OF SAMPLE. DETECTION LIMIT AS INDICATED.

(1) - AS SHOWN ON FIGURE 17. BASED ON TABLE 1.

TABLE 1 (CONTINUED)

SUMMARY-SURFACE SOIL SAMPLING
WITHIN AND OUTSIDE FENCED AREA (PHASE I)
CAROLAWN SITE
FORT LAWN, SOUTH CAROLINA

NUMBER OF DETECTIONS	MEAN SOIL
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PARAMETER	ABOVE ANALYTICAL BACKGROUND (OF 8 TOTAL) (1)	ANALYTICAL BACKGROUND (MG/KG)
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METALS

ARSENIC	8	25.7
CHROMIUM	8	16.4
COPPER	8	50.0
CYANIDE	0	1.0
LEAD	8	2.95

VOLATILES (UG/KG)

METHYLENE CHLORIDE	1	10
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SEMI-VOLATILES (UG/KG)

BIS (2-ETHYLHEXYL) PHTHALATE	1	330
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NOTES:

SAMPLES COLLECTED ON JUNE 5-12, 1985. ANALYZED BY COMPUCHEM LABORATORIES.

U - NOT DETECTED WITHIN MINIMUM, ATTAINABLE DETECTION LIMIT OF SAMPLE. DETECTION LIMIT AS INDICATED.

(1) - AS SHOWN ON FIGURE 17. BASED ON TABLE 1.

TABLE 2

SUMMARY OF SUB-SURFACE
CAROLAWN SITE-FORT LAWN, SOUTH CAROLINA

BORING LOCATION	DETECTION	SB-1	SB-2	SB-3
SAMPLE DEPTH	LIMIT	3.0-4.4 FT.	3.0-5.9 FT.	3.0-4.40 FT.

PARAMETER

METALS (MG/KG)

ARSENIC	0.25	16	24	14.0
CHROMIUM	1.50	28	22.0	5.0
COPPER	1.0	34	100	10
CYANIDE	1.0	U		
LEAD	0.25	2.1	3.7	7.0

VOLATILES (UG/KG)

METHYLENE CHLORIDE	10	10
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SEMI-VOLATILES (UG/KG)

BIS (2-ETHYL HEXYL)

PHTHALATE	330
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PENTACHLOROPHENOL	50	U	U	U
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NOTES:

SAMPLES COLLECTED JUNE 5 - 12, 1986. ANALYZED BY COMPUCEM LABORATORIES.

U - NOT DETECTED WITHIN MINIMUM, ATTAINABLE DETECTION LIMIT OF SAMPLE.

TABLE 2 (CONTINUED)

SUMMARY OF SUB-SURFACE
CAROLAWN SITE-FORT LAWN, SOUTH CAROLINA

BORING LOCATION	DETECTION	SB-4	SB-4	SB-4
SAMPLE DEPTH	LIMIT	2.8-6.8 FT.	6.8-10.8 FT.	10.8-14.8 FT.

PARAMETER

METALS (MG/KG)

ARSENIC	0.25	29	26	12
CHROMIUM	1.50	7.5	4.0	3.0
COPPER	1.0	21	22	14
CYANIDE	1.0	U	U	U
LEAD	0.25	2.9	2.1	1.6

VOLATILES (UG/KG)

METHYLENE CHLORIDE 10

SEMI-VOLATILES (UG/KG)

BIS (2-ETHYL HEXYL)

PHTHALATE 330

PENTACHLOROPHENOL	50	U	U	U
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NOTES:

SAMPLES COLLECTED JUNE 5 - 12, 1986. ANALYZED BY COMPUCHEM LABORATORIES.

U - NOT DETECTED WITHIN MINIMUM, ATTAINABLE DETECTION LIMIT OF SAMPLE.

TABLE 2 (CONTINUED)

SUMMARY OF SUB-SURFACE
CAROLAWN SITE-FORT LAWN, SOUTH CAROLINA

BORING LOCATION	DETECTION	SB-5	SB-6	EQUIPMENT RINSE DEIONIZED WATER
SAMPLE DEPTH	LIMIT	2.8-6.8 FT.	6.8-10.8 FT.	(UG/L)
PARAMETER				
METALS (MG/KG)				
ARSENIC	0.25	25	7.9	0.5.0

CHROMIUM	1.50	18	11	0.3
COPPER	1.0	77	22	
CYANIDE	1.0		U	0.2
LEAD				

VOLATILES (UG/KG)

METHYLENE CHLORIDE 10

SEMI-VOLATILES (UG/KG)

BIS (2-ETHYL HEXYL)
 PHTHALATE 330

PENTACHLOROPHENOL 50

NOTES:

SAMPLES COLLECTED JUNE 5 - 12, 1986. ANALYZED BY COMPUCHEM
 LABORATORIES.

U - NOT DETECTED WITHIN MINIMUM, ATTAINABLE DETECTION LIMIT OF
 SAMPLE.

TABLE 3

TYPICAL ELEMENTAL COMPOSITION OF SOIL
 CAROLAWN SITE - FORT LAWN, SOUTH CAROLINA

ELEMENT	RANGE	CONCENTRATION IN SOILS MG/KG (PPM)	
		TYPICAL MEDIUM	SOURCE
ANTIMONY	0.2-150	6	1,2,3,&4
ARSENIC	0.1-194	11	5
BARIUM	100-3,000	500	1
BERYLLIUM	0.01-40	0.3	1
CADMIUM	0.01-7	0.5	6
CHROMIUM	5-3,000	100	6
COPPER	2-250	30	1
IRON	100-550,000	40,000	1 AND 5

LEAD	LT1-888	29	5
NICKEL	0.1-1,530	50	1 AND 5
SELENIUM	0.1-38	0.4	1 AND 6
SILVER	0.01-0.8	0.4	5
THALLIUM	0.01-0.8	0.2	1
ZINC	1-2,000	90	1 AND 5

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TABLE 4

SUMMARY OF METALS IN SOILS (MG/KG)
CAROLAWN SITE - FORT LAWN, SOUTH CAROLINA

PARAMETER	TYPICAL(1)	SURFACE SOIL	
	MEDIUM	AVERAGE	(% ND)
ANTIMONY	6	1.2	(83)

ARSENIC	11	5	(0)
BARIUM	500	126	(33)
BERYLLIUM	0.3	--	(100)
CADMIUM	0.5	0.6	(50)
CHROMIUM	100	42	(33)
COPPER	30	78	(33)
LEAD	29	80	(33)
MERCURY	0.098	0.03	(17)
NICKEL	50	10	(50)
SELENIUM	0.4	--	(100)
SILVER	0.4	--	(100)
TITANIUM	0.2	--	(100)
ZINC	90	32	(50)

NOTES:

(% ND) - PERCENT OF SAMPLES NOT INCLUDED IN THE AVERAGE BECAUSE
BELOW DETECTION LIMIT

NA - NOT ANALYZED

(1) - FROM TABLE 5.3

TABLE 4 (CONTINUED)

SUMMARY OF METALS IN SOILS (MG/KG)
CAROLAWN SITE - FORT LAWN, SOUTH CAROLINA

PARAMETER	SUBSURFACE SOIL		RANGE
	AVERAGE	(% ND)	
ANTIMONY	NA		1.2
ARSENIC	19	(0)	3.2 - 2.9
BARIUM	NA		40 - 320
BERYLLIUM	NA		--
CADMIUM	NA		0.40 - 0.77
CHROMIUM	12	(0)	3 - 93
COPPER	38	(0)	11 - 190
LEAD	3	(0)	1.6 - 160
MERCURY	NA		0.0055 - 0.12
NICKEL	NA		7 - 12
SELENIUM	NA		--
SILVER	NA		--
TITANIUM	NA		--
ZINC	NA		15 - 57

NOTES:

(% ND) - PERCENT OF SAMPLES NOT INCLUDED IN THE AVERAGE BECAUSE
BELOW DETECTION LIMIT
NA - NOT ANALYZED
(1) - FROM TABLE 5.3

TABLE 5

SUMMARY OF DETECTED COMPOUNDS - PHASE I GROUNDWATER
CAROLAWN SITE - FORT LAWN, SOUTH CAROLINA

LOCATION DATE PARAMETER	DETECTION LIMIT (UG/L)	WELL MW1		WELL MW2	
		7/86	12/86	7/86	12/86
PH(FIELD)		7.24	7.24	7.00	7.00
PH(LAB)		7.3	6.9	7.0	7.0
SPEC. COND(2)(FIELD)		279	220	700	700
SPEC. COND(LAB)		310	260	540	540
TDS MG/L		210	24	370	390
TOC MG/L	0.5 MG/L	U		4.5	3.5
SULFATE MG/L		14		43	43
CHLORIDE MG/L		9.7	10.7	62	62
PHENOLS MG/L	0.1	U		0.6	U
ALUMINUM	200	U		333	297
ARSENIC	10	U		U	U
BARIUM	200	U		220	214
BERYLLIUM	5	S		U	U
CADMIUM	5	U		6.6	6.6
CALCIUM	5000	30,500		42,200	41,900
CHROMIUM	10	U		120	10
COBALT	50	U		U	U
COPPER	25	U		U	U
IRON	100	167		435	452
LEAD	5	23	U	27	28
MAGNESIUM	5000	11,400		24,400	24,200
MANGANESE	15	120		17	17
MERCURY	0.2	U		U	U
NICKEL	70	U		U	U
POTASSIUM	5000	U		6,600	6,700
SODIUM	5000	17,900		24,300	24,400
VANADIUM	50			U	U
ZINC	20	68		192	50

TABLE 5 (CONTINUED)

SUMMARY OF DETECTED COMPOUNDS - PHASE I GROUNDWATER
CAROLAWN SITE - FORT LAWN, SOUTH CAROLINA

LOCATION DATE PARAMETER	DETECTION LIMIT (UG/L)	WELL MW3		WELL MW4	
		7/86	12/86	7/86	12/86
PH(FIELD)		7.13	6.86	7.81	7.04
PH(LAB)		7.3	6.6	7.7	6.0
SPEC. COND(2)(FIELD)		620	392	680	382
SPEC. COND(LAB)		560	550	460	500
TDS MG/L		370	350	320	304
TOC MG/L	0.5 MG/L	18		5.8	
SULFATE MG/L		30		26	
CHLORIDE MG/L		49	50.0	35	40.8
PHENOLS MG/L	0.1	U		U	
ALUMINUM	200	294		1,400	
ARSENIC	10	11		U	
BARIUM	200	6.6		U	
BERYLLIUM	5	46,300		U	
CADMIUM	5	U		U	
CALCIUM	5000	U		46,100	
CHROMIUM	10	U		U	
COBALT	50	856		U	
COPPER	25	26	U	32	
IRON	100	25,400		2,091	
LEAD	5	58		26	
MAGNESIUM	5000	U		22,500	
MANGANESE	15	U		151	
MERCURY	0.2	7,000		U	
NICKEL	70	25,600		U	
POTASSIUM	5000	U		5700	
SODIUM	5000	73		13900	
VANADIUM	50			U	
ZINC	20	68		2,160	

TABLE 5 (CONTINUED)

SUMMARY OF DETECTED COMPOUNDS - PHASE I GROUNDWATER
CAROLAWN SITE - FORT LAWN, SOUTH CAROLINA

LOCATION DATE PARAMETER	DETECTION LIMIT (UG/L)	WELL RW1 ROCKHOLT		WELL RW2 HUNTER	
		7/86	12/86	7/86	12/86
PH(FIELD)		7.01	6.9	6.23	6.5
PH(LAB)		7.3	6.9	6.4	6.1
SPEC. COND(2)(FIELD)		520	430	138	150
SPEC. COND(LAB)		580	650	150	5-JAN
TDS MG/L		460	420	150	152
TOC MG/L	0.5 MG/L	3.8		3	
SULFATE MG/L		43	19	25	
CHLORIDE MG/L		65.0	60.2	11	13.4
PHENOLS MG/L	0.1	U		U	
ALUMINUM	200	3700		U	
ARSENIC	10	U		U	
BARIUM	200	U		U	
BERYLLIUM	5	U		U	
CADMIUM	5	U		U	
CALCIUM	5000	59,100		10,100	
CHROMIUM	10	16		U	
COBALT	50	U		U	
COPPER	25	184		45	
IRON	100	32,600	U	2,100	
LEAD	5	20		U	14
MAGNESIUM	5000	33,900		4,830	
MANGANESE	15	1010		U	
MERCURY	0.2	U		U	
NICKEL	70	61		U	
POTASSIUM	5000	5500		U	
SODIUM	5000	14,800		10,500	
VANADIUM	50	62		U	
ZINC	20	382		1,059	

TABLE 5 (CONTINUED)

SUMMARY OF DETECTED COMPOUNDS - PHASE I GROUNDWATER
CAROLAWN SITE - FORT LAWN, SOUTH CAROLINA

LOCATION DATE PARAMETER	DETECTION LIMIT (UG/L)	WELL RW3 M. MORRISON	WELL RW4 M. MORRISON
		7/86	7/86

PH(FIELD)		6.5	5.95
PH(LAB)		7	6.2
SPEC. COND(2)(FIELD)		1128	242
SPEC. COND(LAB)		160	260
TDS MG/L		140	280
TOC MG/L	0.5 MG/L	0.8	3.4
SULFATE MG/L		8.5	3
CHLORIDE MG/L		11	8
PHENOLS MG/L	0.1	U	U
ALUMINUM	200	U	U
ARSENIC	10	U	U
BARIUM	200	U	394
BERYLLIUM	5	U	U
CADMIUM	5	U	U
CALCIUM	5000	8,400	17,200
CHROMIUM	10	U	U
COBALT	50	U	U
COPPER	25	U	UU
IRON	100	165	3490
LEAD	5	U	2.6
MAGNESIUM	5000	5,360	8
MANGANESE	15	U	46
MERCURY	0.2	U	U
NICKEL	70	U	U
POTASSIUM	5000	U	U
SODIUM	5000	16,800	14,600
VANADIUM	50	U	U
ZINC	20	100	95

TABLE 5 (CONTINUED)

SUMMARY OF DETECTED COMPOUNDS - PHASE I GROUNDWATER
CAROLAWN SITE - FORT LAWN, SOUTH CAROLINA

LOCATION DATE PARAMETER	DETECTION LIMIT (UG/L)	WELL MW1		WELL MW2	
		7/86	12/86	7/86	12/86

VOLATILE ORGANICS

METHYLENE CHLORIDE	5.0	U	5 B	U	5
ACETONE	10	U	705 B	12 B	33 B
TRANS 1,2-DICHLOROETHENE	5.0	U	U	7.2	7.8

TRICHLOROETHENE	5.0	U	U	7.9	7.9
1,1 DICHLOROETHENE	5.0	U	U	U	U
1,1 DICHLOROETHENE	5.0	U	U	U	U
1,1, TRICHLOROETHANE	5.0	U	U	U	U
TOTAL XYLENES	5.0	U	U	U	U
CHLOROFORM	5.0	U	U	U	U

SEMI-VOLATILES

BIS(2-ETHYLHEXYL) PHALATE	10	U	U
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NOTES:

(1) CONCENTRATIONS IN UG/L UNLESS OTHERWISE NOTED. SAMPLES COLLECTED JULY 9 THROUGH JULY 11, 1986, ANALYZED BY COMPUCHEM LABORATORIES. SAMPLES COLLECTED DECEMBER 17, 1986, ANALYZED BY DAVIS & FLOYD INC. ALL METALS ANALYSES WERE PERFORMED ON UNFILTERED SAMPLES.

(2) SPECIFIC CONDUCTANCE IN UMHOS/CM

(3) DETECTION LIMIT FOR REPORTED VOLATILE ANALYSES FOR SAMPLE FROM MW-3 COLLECTED ON 7/9/86 WAS 17 UG/L BECAUSE OF DILUTION FACTOR.

U - NOT DETECTED WITHIN MINIMUM ATTAINABLE DETECTION LIMIT OF SAMPLE.

B - ANALYTE FOUND IN BLANK AS WELL AS SAMPLE. POSSIBLE/PROBABLY BLANK CONTAMINATION.

C - POSSIBLE CARRYOVER CONTAMINATION FROM PREVIOUS LABORATORY SAMPLE RUN, AS INDICATED BY LOW MATRIX SPIKE RECOVERIES FOR COMPOUNDS AS FLAGGED.

TABLE 5 (CONTINUED)

SUMMARY OF DETECTED COMPOUNDS - PHASE I GROUNDWATER CAROLAWN SITE - FORT LAWN, SOUTH CAROLINA

LOCATION DATE PARAMETER	DETECTION LIMIT (UG/L)	WELL MW3		WELL MW4	
		7/86	12/86	7/86	12/86

VOLATILE ORGANICS

METHYLENE CHLORIDE	5.0	17 U	9 B	U	5 B
ACETONE	10	U	81 B	23 B	8 B
TRANS 1,2-DICHLOROETHENE	5.0	U	24	210	467
TRICHLOROETHENE	5.0	460	362	220	439
1,1 DICHLOROETHENE	5.0	71	108	U	22
1,1 DICHLOROETHENE	5.0	U	12	U	8
1,1, TRICHLOROETHANE	5.0	120	128	9.2	30
TOTAL XYLENES	5.0	U	U	13	U
CHLOROFORM	5.0	U	U	U	S

SEMI-VOLATILES

BIS(2-ETHYLHEXYL) PHALATE	10	U	350
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NOTES:

(1) CONCENTRATIONS IN UG/L UNLESS OTHERWISE NOTED. SAMPLES COLLECTED JULY 9 THROUGH JULY 11, 1986, ANALYZED BY COMPUCHEM LABORATORIES. SAMPLES COLLECTED DECEMBER 17, 1986, ANALYZED BY DAVIS & FLOYD INC. ALL METALS ANALYSES WERE PERFORMED ON UNFILTERED SAMPLES.

(2) SPECIFIC CONDUCTANCE IN UMHOS/CM

(3) DETECTION LIMIT FOR REPORTED VOLATILE ANALYSES FOR SAMPLE FROM MW-3 COLLECTED ON 7/9/86 WAS 17 UG/L BECAUSE OF DILUTION FACTOR.

- U - NOT DETECTED WITHIN MINIMUM ATTAINABLE DETECTION LIMIT OF SAMPLE.
- B - ANALYTE FOUND IN BLANK AS WELL AS SAMPLE. POSSIBLE/PROBABLY BLANK CONTAMINATION.
- C - POSSIBLE CARRYOVER CONTAMINATION FROM PREVIOUS LABORATORY SAMPLE RUN, AS INDICATED BY LOW MATRIX SPIKE RECOVERIES FOR COMPOUNDS AS FLAGGED.

TABLE 5 (CONTINUED)

SUMMARY OF DETECTED COMPOUNDS - PHASE I GROUNDWATER
CAROLAWN SITE - FORT LAWN, SOUTH CAROLINA

LOCATION	DETECTION	WELL RW1		WELL RW2	
DATE	LIMIT	ROCKHOLT		HUNTER	
PARAMETER	(UG/L)	7/86	12/86	7/86	12/86

VOLATILE ORGANICS

METHYLENE CHLORIDE	5.0	U	7 B	U	5 B
ACETONE	10	U	15 B	U	24 B
TRANS 1,2-DICHLOROETHENE	5.0	76	84	U	16 C
TRICHLOROETHENE	5.0	230	171	U	21 C
1,1 DICHLOROETHENE	5.0	U	5	U	U
1,1 DICHLOROETHENE	5.0	U	U	U	U
1,1, TRICHLOROETHANE	5.0	U	U	U	U
TOTAL XYLENES	5.0	U	U	U	U
CHLOROFORM	5.0	U	U	U	U

SEMI-VOLATILES

BIS(2-ETHYLHEXYL)					
PHALATE	10	U		U	

NOTES:

(1) CONCENTRATIONS IN UG/L UNLESS OTHERWISE NOTED. SAMPLES COLLECTED JULY 9 THROUGH JULY 11, 1986, ANALYZED BY COMPUCEM LABORATORIES. SAMPLES COLLECTED DECEMBER 17, 1986, ANALYZED BY DAVIS & FLOYD INC. ALL METALS ANALYSES WERE PERFORMED ON UNFILTERED SAMPLES.

(2) SPECIFIC CONDUCTANCE IN UMHOS/CM

(3) DETECTION LIMIT FOR REPORTED VOLATILE ANALYSES FOR SAMPLE FROM MW-3 COLLECTED ON 7/9/86 WAS 17 UG/L BECAUSE OF DILUTION FACTOR.

U - NOT DETECTED WITHIN MINIMUM ATTAINABLE DETECTION LIMIT OF SAMPLE.

B - ANALYTE FOUND IN BLANK AS WELL AS SAMPLE. POSSIBLE/PROBABLY BLANK CONTAMINATION.

C - POSSIBLE CARRYOVER CONTAMINATION FROM PREVIOUS LABORATORY SAMPLE RUN, AS INDICATED BY LOW MATRIX SPIKE RECOVERIES FOR COMPOUNDS AS FLAGGED.

TABLE 5 (CONTINUED)

SUMMARY OF DETECTED COMPOUNDS - PHASE I GROUNDWATER
CAROLAWN SITE - FORT LAWN, SOUTH CAROLINA

LOCATION	DETECTION	WELL RW3	WELL RW4
DATE	LIMIT	M. MORRISON	M. MORRISON
PARAMETER	(UG/L)	7/86	7/86

VOLATILE ORGANICS

METHYLENE CHLORIDE	5.0	U	U
ACETONE	10	U	U
TRANS 1,2-DICHLOROETHENE	5.0	U	U
TRICHLOROETHENE	5.0	U	U
1,1 DICHLOROETHENE	5.0	U	U
1,1 DICHLOROETHENE	5.0	U	U
1,1, TRICHLOROETHANE	5.0	U	U
TOTAL XYLENES	5.0	U	U
CHLOROFORM	5.0	U	U

SEMI-VOLATILES

BIS(2-ETHYLHEXYL)			
PHALATE	10	U	U

NOTES:

(1) CONCENTRATIONS IN UG/L UNLESS OTHERWISE NOTED. SAMPLES COLLECTED JULY 9 THROUGH JULY 11, 1986, ANALYZED BY COMPUCEM LABORATORIES. SAMPLES COLLECTED DECEMBER 17, 1986, ANALYZED BY DAVIS & FLOYD INC. ALL METALS ANALYSES WERE PERFORMED ON UNFILTERED SAMPLES.

(2) SPECIFIC CONDUCTANCE IN UMHOS/CM

(3) DETECTION LIMIT FOR REPORTED VOLATILE ANALYSES FOR SAMPLE FROM MW-3 COLLECTED ON 7/9/86 WAS 17 UG/L BECAUSE OF DILUTION FACTOR.

U - NOT DETECTED WITHIN MINIMUM ATTAINABLE DETECTION LIMIT OF SAMPLE.

B - ANALYTE FOUND IN BLANK AS WELL AS SAMPLE. POSSIBLE/PROBABLY BLANK CONTAMINATION.

C - POSSIBLE CARRYOVER CONTAMINATION FROM PREVIOUS LABORATORY
SAMPLE RUN, AS INDICATED BY LOW MATRIX SPIKE RECOVERIES FOR
COMPOUNDS AS FLAGGED.

TABLE 6

SUMMARY OF DETECTED COMPOUNDS - PHASE II GROUNDWATER
CAROLAWN SITE - FORT LAWN, SOUTH CAROLINA

VOLATILE ORGANIC COMPOUNDS	MW1	MW2	MW3	MW4	MW5
ROUND 1					
ACETONE	11,000	29,000	6,200	9,000	31,000
CHLOROFORM	ND (250)	ND (1000)	ND (170)	ND (170)	ND (830)
1,1-DICHLOROETHANE	ND (250)	ND (1000)	ND (170)	ND (170)	ND (830)
1,1-DICHLOROETHENE	10	ND (1000)	ND (170)	ND (170)	ND (830)
1,2-DICHLOROETHENE	ND (250)	ND (1000)	ND (170)	470	ND (830)
(TOTAL)					
1,1,1- TRICHLOROETHANE	ND (250)	ND (1000)	ND (170)	ND (170)	ND (830)
TRICHLOROETHENE	ND (250)	ND (1000)	440	560	ND (830)

ROUND 2

ACETONE	ND (50)	ND (50)	ND (250)	ND (130)	620
1,1-DICHLOROETHANE	ND (31)	ND (5)	ND (25)	ND (13)	ND (25)
1,1-DICHLOROETHENE	ND (31)	ND (5)	77	ND (13)	18
1,2-DICHLOROETHENE	ND (31)	XX	ND (5)	280	230
(TOTAL)					
1,1,1- TRICHLOROETHANE	ND (31)	ND (5)	63	ND (13)	ND (25)
TRICHLOROETHENE	ND (31)	XX	420	230	180

NOTES: ND - NOT DETECTED AT STATED DETECTION LIMIT
UNITS UG/L
XX - COMPOUND DETECTED, BUT BELOW QUANTITATION LIMIT
NA - NOT ANALYZED

TABLE 6 (CONTINUED)

SUMMARY OF DETECTED COMPOUNDS - PHASE II GROUNDWATER
CAROLAWN SITE - FORT LAWN, SOUTH CAROLINA

VOLATILE ORGANIC COMPOUNDS	MW5-D	MW6	MW6-S	MW7	MW8
ROUND 1					
ACETONE	16,000	ND (350)	ND (500)	9,200	64
CHLOROFORM	ND (830)	ND (35)	ND (50)	ND (330)	ND (5)
1,1-DICHLOROETHANE	ND (830)	ND (35)	ND (50)	ND (330)	ND (5)
1,1-DICHLOROETHENE	ND (830)	70	70	ND (330)	ND (5)
1,2-DICHLOROETHENE	ND (830)	400	440	370	ND (5)
(TOTAL)					
1,1,1- TRICHLOROETHANE	ND (830)	40	XX	ND (330)	ND (5)
TRICHLOROETHENE	ND (830)	120	1,100	510	ND (5)
ROUND 2					
ACETONE	130	ND (50)	1,400	ND (250)	ND (50)
1,1-DICHLOROETHANE	6	ND (50)	ND (50)	ND (25)	ND (5)
1,1-DICHLOROETHENE	14	170	120	16	ND (5)
1,2-DICHLOROETHENE	210	450	420	470	ND (5)
(TOTAL)					
1,1,1- TRICHLOROETHANE	14	64	66	ND (25)	ND (5)
TRICHLOROETHENE	160	880	820	620	ND (5)

NOTES: ND - NOT DETECTED AT STATED DETECTION LIMIT
 UNITS UG/L
 XX - COMPOUND DETECTED, BUT BELOW QUANTITATION LIMIT
 NA - NOT ANALYZED

TABLE 6 (CONTINUED)

SUMMARY OF DETECTED COMPOUNDS - PHASE II GROUNDWATER
CAROLAWN SITE - FORT LAWN, SOUTH CAROLINA

VOLATILE ORGANIC COMPOUNDS	MW9	MW10A	MW10B	MW11A	MW11B
ROUND 1					
ACETONE	6,300	100	240	ND (50)	ND (50)
CHLOROFORM	ND (50)	ND (8)	ND (12)	8	ND (17)
1,1-DICHLOROETHANE	ND (50)	ND (8)	ND (12)	ND (5)	ND (17)
1,1-DICHLOROETHENE	ND (50)	10	14	ND (5)	ND (17)
1,2-DICHLOROETHENE	81	80	110	ND (5)	ND (17)
(TOTAL)					
1,1,1- TRICHLOROETHANE	ND (50)	10	19	ND (5)	ND (17)
TRICHLOROETHENE	XX	50	64	13	XX

ROUND 2

ACETONE	ND (250)	NA	2,500	72	ND (100)
1,1-DICHLOROETHANE	ND (25)	NA	ND (50)	ND (5)	ND (10)
1,1-DICHLOROETHENE	ND (25)	NA	ND (50)	ND (5)	ND (10)
1,2-DICHLOROETHENE	67	NA	100	ND (5)	150
(TOTAL)					
1,1,1- TRICHLOROETHANE	ND (25)	NA	ND (50)	ND (5)	ND (10)
TRICHLOROETHENE	45	NA	50	ND (5)	270

NOTES: ND - NOT DETECTED AT STATED DETECTION LIMIT
UNITS UG/L
XX - COMPOUND DETECTED, BUT BELOW QUANTITATION LIMIT
NA - NOT ANALYZED

TABLE 6 (CONTINUED)

SUMMARY OF DETECTED COMPOUNDS - PHASE II GROUNDWATER
CAROLAWN SITE - FORT LAWN, SOUTH CAROLINA

VOLATILE ORGANIC
COMPOUNDS

RW-4 RW-4
(DUP)

ROUND 1

ACETONE	ND (50)	ND (50)
CHLOROFORM	ND (12)	ND (12)
1,1-DICHLOROETHANE	ND (12)	ND (12)
1,1-DICHLOROETHENE	ND (12)	ND (12)
1,2-DICHLOROETHENE	120	120
(TOTAL)		
1,1,1-	ND (12)	ND (12)
TRICHLOROETHANE		
TRICHLOROETHENE	320	240

ROUND 2

ACETONE	ND (100)	NA
1,1-DICHLOROETHANE	ND (10)	NA
1,1-DICHLOROETHENE	ND (10)	NA
1,2-DICHLOROETHENE	150	NA
(TOTAL)		
1,1,1-	ND (10)	NA
TRICHLOROETHANE		
TRICHLOROETHENE	270	NA

NOTES: ND - NOT DETECTED AT STATED DETECTION LIMIT
UNITS UG/L
XX - COMPOUND DETECTED, BUT BELOW QUANTITATION LIMIT
NA - NOT ANALYZED

TABLE 7

SUMMARY OF DETECTED COMPOUNDS - PHASE II GROUNDWATER
CAROLAWN SITE - FORT LAWN, SOUTH CAROLINA

METALS	MW5		MW5-DUPLICATE	
	ROUND 1	ROUND 2	ROUND 1	ROUND 2
ALUMINUM	6,700	4,600	7,400	6,500
BARIUM	220	190	240	190
CALCIUM	50,000	51,000	48,000	51,000
CHROMIUM	50	ND (20)	50	ND (20)
COBALT	ND (50)	ND (50)	ND (50)	ND (50)
COPPER	40	ND (10)	30	ND (10)
IRON	8,500	12,000	10,000	1,200
LEAD	7.3	ND (50)	8.2	ND (50)
MAGNESIUM	25,000	24,000	25,000	24,000
MANGANESE	140	230	150	230
NICKEL	ND (40)	ND (40)	ND (40)	ND (40)
POTASSIUM	7,100	6,700	7,400	6,800
SILVER	20	10	20	ND (10)
SODIUM	19,000	24,000	19,000	14,000
VANADIUM	ND (50)	170	ND (50)	170
ZINC	20	80	20	80

NOTES: ND - NOT DETECTED AT STATED DETECTION LIMIT
UNITS UG/L

TABLE 7 (CONTINUED)

SUMMARY OF DETECTED COMPOUNDS - PHASE II GROUNDWATER
CAROLAWN SITE - FORT LAWN, SOUTH CAROLINA

METALS	MW6		MW6-SPIKE	
	ROUND 1	ROUND 2	ROUND 1	ROUND 2
ALUMINUM	6,500	1,000	12,000	200
BARIUM	960	140	390	170
CALCIUM	100,000	54,000	52,000	59,000
CHROMIUM	80	ND (20)	20	ND (20)
COBALT	60	ND (50)	ND (50)	ND (50)
COPPER	270	ND (10)	30	ND (10)
IRON	87,000	1,400	18,000	3,400
LEAD	80.0	ND (50)	53.0	ND (50)

MAGNESIUM	59,000	19,000	25,000	20,000
MANGANESE	1,400	210	460	260
NICKEL	120	ND (40)	ND (40)	ND (40)
POTASSIUM	30,000	6,200	12,000	7,200
SILVER	ND (10)	ND (10)	ND (10)	10
SODIUM	30,000	25,000	22,000	26,000
VANADIUM	270	ND (50)	ND (50)	ND (50)
ZINC	170	30	70	90

NOTES: ND - NOT DETECTED AT STATED DETECTION LIMIT
UNITS UG/L

TABLE 8

HWSI SAMPLING LOCATIONS
CAROLAWN SITE - FORT LAWN, SOUTH CAROLINA

SAMPLE NUMBER	SAMPLE TYPE	SAMPLING LOCATION
FCU-101	WATER, SEDIMENT	FISHING CREEK UPSTREAM FROM SITE, APPROXIMATELY 200 FEET DOWNSTREAM FROM HIGHWAY 9 BRIDGE.
FCD-100	WATER, SEDIMENT	FISHING CREEK DOWNSTREAM FROM SITE, APPROXIMATELY 200 FEET UPSTREAM FROM RAILROAD TRESSEL.
CD-102	SEDIMENT	DRAINAGE DITCH AT WEST END OF PROPERTY DOWNGRADE FROM DRUMS.
CD-103	SEDIMENT	DRAINAGE DITCH EAST OF SITE.
CD-104	WATER, SEDIMENT	DIKED AREA AROUND LARGE BULK STORAGE TANKS.
CDW-105	WASTE	SPILLAGE IN PHENOL TRAILER.
CDW-106	WASTE	SPILLAGE AT EDGE OF DRUM STORAGE AREA BY LOADING DOCK.
CDW-107	WASTE	SPILLAGE FROM DRUM OUTSIDE FENCE WEST

OF SITE.

CDW-108 WASTE

LEAKAGE FROM TANK IN THE INCINERATOR
AREA AT THE NORTHEAST CORNER OF THE
SITE.

SOURCE - USEPA, 1981

TABLE 9

DATA SUMMARY - WASTE SAMPLES
CAROLAWN SITE - FORT LAWN, SOUTH CAROLINA

	CDW-105 PHENOL TRAILER (MG/KG)	CDW-106 LOADING DOCK (MG/KG)
PURGEABLE ORGANIC COMPOUNDS		
1,1,1-TRICHLOROETHANE(1)	ND	ND
HEXANE(2)	800	--
EXTRACTABLE ORGANIC COMPOUNDS (GC/MS)		
PHENOL(1)	14,000	ND
BIS(2-ETHYL HEXYL)PHTHALATE(1)	ND	ND
C(4) ALKYL PHENOL(2)	18,000	ND
C(10) ALKYL PHENOL(2)	--	--
DODECANOIC ACID(2)	--	26,000
TERRADECANOIC ACID(2)	--	10,000
UNIDENTIFIED COMPOUNDS(3)	--	--
PETROLEUM TYPE COMPOUND	--	P

PESTICIDES, PCBS AND OTHER CHLORINATED
COMPOUNDS (GC/EC)

P,P'-DDE(1)	54	ND
ALPHA BHC(1)	150	ND
BETA BHC(1)	38	ND
GAMA BHC(1)	8.9	ND
DELTA BHC(1)	6.7	ND
O,P'-DDE	20	ND

INORGANIC ELEMENTS AND COMPOUNDS

BARIUM	1,150	1
CADMIUM(1)	9	ND
CHROMIUM(1)	236	0.3
COPPER(1)	127	0.2
MOLYBDEMUM	33	ND
NICKEL(1)	64	ND
LEAD	830	0.8
TIN	343	ND
STRONTIUM	37	0.4
TITANIUM	1,480	0.4
VANADIUM	46	1
YTTRIUM	8	0.1
ZINC(1)	880	1.5
ALUMINUM	24,400	10
MANGANESE	410	0.9
CALCIUM	3,390	70
MAGNESIUM	5,010	8
IRON	60,000	155
SODIUM	ND	13
CYANIDE(1)	9.3	ND

ALL WASTE CONCENTRATIONS ARE CALCULATED ON A WET WEIGHT BASIS.

P - INDICATES PRESENCE.
 NA - NOT ANALYZED.
 ND - NONE DETECTED AT OR ABOVE THE MINIMUM DETECTION LIMIT (MDL). THE MDLS VARY FROM SAMPLE TO SAMPLE AND FROM PARAMETER TO PARAMETER, SEE ANALYTICAL DATA SHEETS (APPENDIX A) FOR EXACT VALUES.
 (1) - COMPOUND/ELEMENT IS ON THE NRDC LIST OF PRIORITY POLLUTANTS.
 (2) - TENTATIVE IDENTIFICATION, ESTIMATED CONCENTRATION.
 (3) - THE VALUE INDICATES THE HIGHEST ESTIMATED CONCENTRATION FOR A COMPOUND IN THIS CLASSIFICATION. THE NUMBER IN PARENTHESES INDICATED THE NUMBER OF COMPOUNDS DETECTED IN THIS CLASSIFICATION.
 (A) - PRESUMPTIVE EVIDENCE OF MATERIAL; NOT CONFIRMED ON GC/MS

1

(B) - OR SECOND GC COLUMN. SEE FOOTNOTE B.
CONFIRMED ON GC/MS. THE LACK OF A FOOTNOTE INDICATES THAT
THE COMPOUND WAS CONFIRMED ON TWO DIFFERENT GC COLUMNS.

TABLE 9 (CONTINUED)

DATA SUMMARY - WASTE SAMPLES
CAROLAWN SITE - FORT LAWN, SOUTH CAROLINA

	CDW-107 DRUM WEST OF FENCE (MG/KG)	CDW-108 LEAKAGE FROM TANK (MG/KG)
PURGEABLE ORGANIC COMPOUNDS		
1,1,1-TRICHLOROETHANE(1)	ND	10
HEXANE(2)	130	--
EXTRACTABLE ORGANIC COMPOUNDS (GC/MS)		
PHENOL(1)	ND	ND
BIS(2-ETHYL HEXYL)PHTHALATE(1)	ND	6,900
C(4) ALKYL PHENOL(2)	ND	ND
C(10) ALKYL PHENOL(2)	320	--
DODECANOIC ACID(2)	--	--
TERRADECANOIC ACID(2)	--	--
UNIDENTIFIED COMPOUNDS(3)	16,000(2)	--
PETROLEUM TYPE COMPOUND	--	P
PESTICIDES, PCBS AND OTHER CHLORINATED COMPOUNDS (GC/EC)		
P,P'-DDE(1)	ND	ND
ALPHA BHC(1)	ND	ND
BETA BHC(1)	ND	ND
GAMA BHC(1)	ND	ND
DELTA BHC(1)	ND	ND
O,P'-DDE	ND	ND

INORGANIC ELEMENTS AND COMPOUNDS

BARIUM	2	ND
CADMIUM(1)	ND	ND
CHROMIUM(1)	1	1
COPPER(1)	2	178
MOLYBDEMUM	ND	ND
NICKEL(1)	ND	ND
LEAD	ND	ND
TIN	ND	ND
STRONTIUM	1	ND
TITANIUM	55	2
VANADIUM	1	ND
YTTRIUM	ND	ND
ZINC(1)	2	1
ALUMINUM	940	13
MANGANESE	6	ND
CALCIUM	30	ND
MAGNESIUM	61	ND
IRON	1,120	31
SODIUM	1,500	ND
CYANIDE(1)	ND	ND

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- (3) - THE VALUE INDICATES THE HIGHEST ESTIMATED CONCENTRATION FOR A COMPOUND IN THIS CLASSIFICATION. THE NUMBER IN PARENTHESES INDICATED THE NUMBER OF COMPOUNDS DETECTED IN THIS CLASSIFICATION.
- (A) - PRESUMPTIVE EVIDENCE OF MATERIAL; NOT CONFIRMED ON GC/MS OR SECOND GC COLUMN. SEE FOOTNOTE B.
- (B) - CONFIRMED ON GC/MS. THE LACK OF A FOOTNOTE INDICATES THAT THE COMPOUND WAS CONFIRMED ON TWO DIFFERENT GC COLUMNS.

TABLE 10

DATA SUMMARY - WATER AND SEDIMENT SAMPLES
CAROLAWN SITE - FORT LAWN, SOUTH CAROLINA

		SEDIMENT	
	FCU-101 FISHING CR. UPSTREAM (UG/KG)	FCD-100 FISHING CR. DOWNSTREAM (UG/KG)	CD-101 DITCH WEST OF PROPERTY (UG/KG)
PURGEABLE ORGANIC COMPOUNDS			
TRICHLOROFLUOROETHANE (1)	ND	ND	ND
1,1-DICHLOROETHYLENE (1)	ND	ND	ND
1,1-DICHLOROETHANE (1)	ND	ND	ND
1,2-TRANS-DICHLOROETHYLENE (1)	ND	ND	ND
1,1,1-TRICHLOROETHANE (1)	ND	ND	ND
TRICHLOROETHYLENE (1)	ND	ND	ND
1,1,2,2-TETRACHLOROETHANE (1)	ND	ND	ND
EXTRACTABLE ORGANIC COMPOUNDS (GC/MS)			
N-BUTYL BENZYL PHTHALATE (1)	ND	3,000	ND
BIS (2-ETHYL HEXYL)PHTHALATE	ND	9,200	ND
CHRYSENE AND/OR BENZO(A)			
ANTHRACENE (1)	ND	3,000	ND
C,ALKYL PHENOL (2)	--	--	--
UNIDENTIFIED COMPOUNDS (3)	--	13,000 (4)	--
PETROLEUM TYPE PRODUCT	--	--	--
PESTICIDES, PCBS, AND OTHER CHLORINATED COMPOUNDS (CC/IC)			
PCB-1234	ND	310	ND
INORGANIC ELEMENTS AND COMPOUNDS			
BARIUM	36	32	97

CADMIUM(1)	ND	ND	2
CHROMIUM(1)	9	3	32
COPPER(1)	2	1	92
NICKEL(1)	ND	ND	14
LEAD(1)	4	ND	81
MOLYBDENUM	ND	ND	ND
STRONTIUM	3	3	39
TITANIUM	185	122	712
VANADIUM	13	10	33
YTTRIUM	3	3	6
ZINC(1)	12	10	41
MERCURY(1)	ND	ND	0.33
CYANIDE(1)	ND	ND	0.43
ALUMINUM	2,200	1,470	11,600
MANGANESE	300	350	180
CALCIUM	400	250	2,100
MAGNESIUM	300	383	1,800
IRON	6,100	3,100	11,800
SODIUM	ND	ND	ND

CONVENTIONAL PARAMETERS
(UNITS AS SPECIFIED FOR EACH PARAMETER)

TEMPERATURE (DEGREES CENTIGRADE)	--	--	--
PH(SU)	--	--	--

ALL WASTE CONCENTRATIONS ARE CALCULATED ON A WET WEIGHT BASIS.

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- ND - NONE DETECTED AT OR ABOVE THE MINIMUM DETECTION LIMIT (MDL). THE MDLS VARY FROM SAMPLE TO SAMPLE AND FROM PARAMETER TO PARAMETER, SEE ANALYTICAL DATA SHEETS (APPENDIX A) FOR EXACT VALUES.
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TABLE 10 (CONTINUED)

DATA SUMMARY - WATER AND SEDIMENT SAMPLES
CAROLAWN SITE - FORT LAWN, SOUTH CAROLINA

	SEDIMENT		WATER
	CD-103 DITCH EAST OF PROPERTY (UG/KG)	CD-104 DIKED AREA AROUND TANKS (UG/KG)	FCU-101 FISHING CR. UPSTREAM (UG/L)
PURGEABLE ORGANIC COMPOUNDS			
TRICHLOROFLUOROETHANE(1)	ND	ND	ND
1,1-DICHLOROETHYLENE(1)	ND	ND	ND
1,1-DICHLOROETHANE(1)	ND	ND	ND
1,2-TRANS-DICHLOROETHYLENE(1)	ND	9.7	ND
1,1,1-TRICHLOROETHANE(1)	ND	ND	ND
TRICHLOROETHYLENE(1)	ND	5	ND
1,1,2,2-TETRACHLOROETHANE(1)	ND	5	ND
EXTRACTABLE ORGANIC COMPOUNDS (GC/MS)			
N-BUTYL BENZYL PHTHALATE(1)	ND	ND	ND
BIS (2-ETHYL HEXYL)PHTHALATE	ND	ND	ND
CHRYSENE AND/OR BENZO(A)			
ANTHRACENE(1)	ND	ND	ND
C,ALKYL PHENOL(2)	--	--	--
UNIDENTIFIED COMPOUNDS(3)	--	--	--
PETROLEUM TYPE PRODUCT	--	--	--
PESTICIDES, PCBS, AND OTHER CHLORINATED COMPOUNDS (CC/IC)			
PCB-1234	ND	86	ND

INORGANIC ELEMENTS AND COMPOUNDS

BARIUM	61	164	36
CADMIUM(1)	ND	ND	2
CHROMIUM(1)	23	30	ND
COPPER(1)	26	63	ND
NICKEL(1)	14	23	ND
LEAD(1)	8	13	ND
MOLYBDENUM	ND	ND	ND
STRONTIUM	46	91	87
TITANIUM	1,070	977	61
VANADIUM	44	40	ND
YTTRIUM	7	9	ND
ZINC(1)	18	30	11
MERCURY(1)	ND	ND	ND
CYANIDE(1)	0.29	ND	ND
ALUMINUM	8,300	19,800	2,800
MANGANESE	215	95	75
CALCIUM	3,700	7,600	9,100
MAGNESIUM	3,100	3,100	4,000
IRON	13,200	13,800	2,700
SODIUM	250	1,200	6,000

CONVENTIONAL PARAMETERS

(UNITS AS SPECIFIED FOR EACH PARAMETER)

TEMPERATURE (DEGREES CENTIGRADE)	--	--	25
PH(SU)	--	--	6.9

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- (3) - THE VALUE INDICATES THE HIGHEST ESTIMATED CONCENTRATION FOR A COMPOUND IN THIS CLASSIFICATION. THE NUMBER IN PARENTHESES INDICATED THE NUMBER OF COMPOUNDS DETECTED IN THIS CLASSIFICATION.

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OR SECOND GC COLUMN. SEE FOOTNOTE B.
- (B) - CONFIRMED ON GC/MS. THE LACK OF A FOOTNOTE INDICATES THAT
THE COMPOUND WAS CONFIRMED ON TWO DIFFERENT GC COLUMNS.

TABLE 10 (CONTINUED)

DATA SUMMARY - WATER AND SEDIMENT SAMPLES
CAROLAWN SITE - FORT LAWN, SOUTH CAROLINA

WATER

FCD-100	CD-104
FISHING CR.	DIKED AREA
DOWNSTREAM	AROUND TANKS
(UG/KG)	(UG/KG)

PURGEABLE ORGANIC COMPOUNDS

TRICHLOROFLUOROETHANE(1)	ND	8.1
1,1-DICHLOROETHYLENE(1)	ND	3
1,1-DICHLOROETHANE(1)	ND	3
1,2-TRANS-DICHLOROETHYLENE(1)	ND	230
1,1,1-TRICHLOROETHANE(1)	ND	15
TRICHLOROETHYLENE(1)	ND	260
1,1,2,2-TETRACHLOROETHANE(1)	ND	ND

EXTRACTABLE ORGANIC COMPOUNDS
(GC/MS)

N-BUTYL BENZYL PHTHALATE(1)	ND	ND
BIS (2-ETHYL HEXYL)PHTHALATE	ND	ND
CHRYSENE AND/OR BENZO(A)		
ANTHRACENE(1)	ND	ND
C,ALKYL PHENOL(2)	--	60
UNIDENTIFIED COMPOUNDS(3)	--	--
PETROLEUM TYPE PRODUCT	--	--

PESTICIDES, PCBS, AND OTHER
CHLORINATED COMPOUNDS (CC/IC)

PCB-1234 ND ND

INORGANIC ELEMENTS AND COMPOUNDS

BARIUM	38	66
CADMIUM(1)	ND	ND
CHROMIUM(1)	ND	ND
COPPER(1)	ND	ND
NICKEL(1)	ND	ND
LEAD(1)	ND	ND
MOLYBDENUM	ND	ND
STRONTIUM	87	33
TITANIUM	93	40
VANADIUM	10	ND
YTTRIUM	ND	ND
ZINC(1)	12	14
MERCURY(1)	ND	ND
CYANIDE(1)	ND	ND
ALUMINUM	3,600	1,900
MANGANESE	100	ND
CALCIUM	9,000	3,600
MAGNESIUM	4,000	2,700
IRON	3,500	1,500
SODIUM	6,000	40,000

CONVENTIONAL PARAMETERS
(UNITS AS SPECIFIED FOR EACH PARAMETER)

TEMPERATURE (DEGREES CENTIGRADE)	25	29.5
PH(SU)	7.4	8.3

ALL WASTE CONCENTRATIONS ARE CALCULATED ON A WET WEIGHT BASIS.

P - INDICATES PRESENCE.
NA - NOT ANALYZED.
ND - NONE DETECTED AT OR ABOVE THE MINIMUM DETECTION LIMIT
(MDL). THE MDLS VARY FROM SAMPLE TO SAMPLE AND FROM
PARAMETER TO PARAMETER, SEE ANALYTICAL DATA SHEETS
(APPENDIX A) FOR EXACT VALUES.
(1) - COMPOUND/ELEMENT IS ON THE NRDC LIST OF PRIORITY
POLLUTANTS.
(2) - TENTATIVE IDENTIFICATION, ESTIMATED CONCENTRATION.

- (3) - THE VALUE INDICATES THE HIGHEST ESTIMATED CONCENTRATION FOR A COMPOUND IN THIS CLASSIFICATION. THE NUMBER IN PARENTHESES INDICATED THE NUMBER OF COMPOUNDS DETECTED IN THIS CLASSIFICATION.
- (A) - PRESUMPTIVE EVIDENCE OF MATERIAL; NOT CONFIRMED ON GC/MS OR SECOND GC COLUMN. SEE FOOTNOTE B.
- (B) - CONFIRMED ON GC/MS. THE LACK OF A FOOTNOTE INDICATES THAT THE COMPOUND WAS CONFIRMED ON TWO DIFFERENT GC COLUMNS.

TABLE 11

SURFACE WATER(1)

LOCATION DATE PARAMETER(3)	DETECTION LIMIT (MG/L)	CLWS-107 FISHING CR. UPSTREAM	CLWS-108 FISHING CR. DOWNSTREAM
		10/86 (MG/L)	10/86 (MG/L)
PH (FIELD)		6.92	7.01
PH (LAB)		7.4	7.5
SPEC. COND (FIELD)(4)		93	90
SPEC. COND. (LAB)(4)		155	145
CHLORIDE		6.43	5.92
TDS		108	88
ANTIMONY			
ALUMINUM	0.5	U	U
ARSENIC			
BARIUM	0.2	U	U
BERYLLIUM			
CADMIUM	0.005	U	U
CHROMIUM	0.2		
COPPER			
LEAD	0.005	U	U
MERCURY			
NICKEL	0.04	U	U
MANGANESE	0.02	0.178	0.200
SELENIUM			
SILVER			
THALLIUM			
ZINC	0.01	U	U
VOLATILE ORGANICS	(UG/L)	(UG/L)	(UG/L)

METHYLENE CHLORIDE	5.0	6.0	5.0
ACETONE			

NOTES:

- (1) SAMPLES COLLECTED BY S&ME, INC. ON OCTOBER 21, 1986; ANALYZED BY DAVIS & FLOYD, INC.
- (2) SAMPLES COLLECTED BY HAZTECH THE WEEK OF MAY 19, 1985; ANALYZED BY COMPUCHEM LABORATORIES.
- (3) ALL METALS ANALYZES WERE PERFORMED ON UNFILTERED SAMPLES.
- (4) SPECIFIC CONDUCTANCE MEASUREMENT IN UMHOS/CM.

U - NOT DETECTED WITHIN MINIMUM ATTAINABLE DETECTION LIMIT OF SAMPLE.

B - ANALYTE FOUND IN BLANK AS WELL AS SAMPLE. POSSIBLE/PROBABLE BLANK CONTAMINATION.

TABLE 11 (CONTINUED)

SURFACE WATER(2)

LOCATION	DETECTION	CLWS-102 INTERMITTENT STREAM	CLWS-105 FISHING CR. UPSTREAM	CLSW-106 FISHING CR. DOWNSTREAM
DATE	LIMIT	5/85	5/85	5/85
PARAMETER(3)	(MG/L)	(MG/L)	(MG/L)	(MG/L)
PH (FIELD)				
PH (LAB)				
SPEC. COND (FIELD)(4)				
SPEC. COND. (LAB)(4)				
CHLORIDE				
TDS				
ANTIMONY	0.05	U	U	U
ALUMINUM				
ARSENIC	0.05	U	U	U
BARIUM	1.0	U	U	U

BERYLLIUM	0.02	U	U	U
CADMIUM	0.01	U	U	U
CHROMIUM	0.05	U	U	U
COPPER	0.10	U	U	U
LEAD	0.05	U	U	U
MERCURY	0.0002	U	U	U
NICKEL	0.10	U	U	U
MANGANESE				
SELENIUM	0.01	U	U	U
SILVER	0.05	U	U	U
THALLIUM	0.05	U	U	U
ZINC	0.02	0.04	0.04	0.04

VOLATILE ORGANICS	(UG/L)	(UG/L)	(UG/L)	(UG/L)
METHYLENE CHLORIDE	5.0	5.7	U	3.0
ACETONE	10.0			

NOTES:

- (1) SAMPLES COLLECTED BY S&ME, INC. ON OCTOBER 21, 1986; ANALYZED BY DAVIS & FLOYD, INC.
- (2) SAMPLES COLLECTED BY HAZTECH THE WEEK OF MAY 19, 1985; ANALYZED BY COMPUCHEM LABORATORIES.
- (3) ALL METALS ANALYZES WERE PERFORMED ON UNFILTERED SAMPLES.
- (4) SPECIFIC CONDUCTANCE MEASUREMENT IN UMHOS/CM.

U - NOT DETECTED WITHIN MINIMUM ATTAINABLE DETECTION LIMIT OF SAMPLE.

B - ANALYTE FOUND IN BLANK AS WELL AS SAMPLE. POSSIBLE/PROBABLE BLANK CONTAMINATION.

TABLE 11 (CONTINUED)

SEDIMENT(2)

CLSD-101	CLSD-102	CLSD-103
DITCH WEST	INTERMITTENT	INTERMITTENT

LOCATION	DETECTION	OF SITE	STREAM	STREAM
DATE	LIMIT	5/85	5/85	5/85
PARAMETER(3)	(MG/KG)	(MG/KG)	(MG/KG)	(MG/KG)

PH (FIELD)

PH (LAB)

SPEC. COND (FIELD)(4)

SPEC. COND. (LAB)(4)

CHLORIDE

TDS

ANTIMONY	0.05	U	U	U
ALUMINUM				
ARSENIC	0.05	U	U	U
BARIUM	10.0	U	U	U
BERYLLIUM	0.2	U	U	U
CADMIUM	0.1	U	U	U
CHROMIUM	0.5	U	U	U
COPPER	0.002	U	U	U
LEAD	1.0	U	U	U
MERCURY	0.0002	U	U	U
NICKEL	0.10	U	U	U
MANGANESE				
SELENIUM	0.01	U	U	U
SILVER	0.05	U	U	U
THALLIUM	0.05	U	U	U
ZINC	0.02	0.04	0.04	0.04

VOLATILE ORGANICS	(UG/L)	(UG/L)	(UG/L)	(UG/L)
-------------------	--------	--------	--------	--------

METHYLENE CHLORIDE	5.0	21N	14B	6.1B
ACETONE	5.0	7.7N	8.7B	5.9B

NOTES:

- (1) SAMPLES COLLECTED BY S&ME, INC. ON OCTOBER 21, 1986; ANALYZED BY DAVIS & FLOYD, INC.
- (2) SAMPLES COLLECTED BY HAZTECH THE WEEK OF MAY 19, 1985; ANALYZED BY COMPUCEM LABORATORIES.
- (3) ALL METALS ANALYZES WERE PERFORMED ON UNFILTERED SAMPLES.
- (4) SPECIFIC CONDUCTANCE MEASUREMENT IN UMHOS/CM.

U - NOT DETECTED WITHIN MINIMUM ATTAINABLE DETECTION LIMIT OF SAMPLE.

B - ANALYTE FOUND IN BLANK AS WELL AS SAMPLE. POSSIBLE/PROBABLE BLANK CONTAMINATION.

TABLE 11 (CONTINUED)

SEDIMENT(2)

LOCATION	DETECTION	CLSD-104	CLSD-105	CLSD-106
DATE	LIMIT	DITCH EAST	FISHING CR.	FISHING CR.
PARAMETER(3)	(MG/KG)	OF SITE	UPSTREAM	DOWNSTREAM
		5/85	5/85	5/85
		(MG/KG)	(MG/KG)	(MG/KG)
PH (FIELD)				
PH (LAB)				
SPEC. COND (FIELD)(4)				
SPEC. COND. (LAB)(4)				
CHLORIDE				
TDS				
ANTIMONY	0.05	U	U	U
ALUMINUM				
ARSENIC	0.05	6.0	1.1	U
BARIUM	10.0	72	U	U
BERYLLIUM	0.2	U	U	U
CADMIUM	0.1	U	U	U
CHROMIUM	0.5	13	U	U
COPPER	0.002	25	U	U
LEAD	1.0	3.8	U	U
MERCURY	0.0002	0.0077	0.011	0.0052
NICKEL	0.10	11	U	U
MANGANESE				
SELENIUM	0.01	U	U	U
SILVER	0.05	U	U	U
THALLIUM	0.05	U	U	U
ZINC	0.02	12	0.04	??(4)
VOLATILE ORGANICS	(UG/L)	(UG/L)	(UG/L)	(UG/L)
METHYLENE CHLORIDE	5.0	25B	16B	19B
ACETONE	10.0	9.7B	22B	45B

NOTES:

- (1) SAMPLES COLLECTED BY S&ME, INC. ON OCTOBER 21, 1986; ANALYZED BY DAVIS & FLOYD, INC.
 - (2) SAMPLES COLLECTED BY HAZTECH THE WEEK OF MAY 19, 1985; ANALYZED BY COMPUCHEM LABORATORIES.
 - (3) ALL METALS ANALYZES WERE PERFORMED ON UNFILTERED SAMPLES.
 - (4) SPECIFIC CONDUCTANCE MEASUREMENT IN UMHOS/CM.
- U - NOT DETECTED WITHIN MINIMUM ATTAINABLE DETECTION LIMIT OF SAMPLE.
- B - ANALYTE FOUND IN BLANK AS WELL AS SAMPLE. POSSIBLE/PROBABLE BLANK CONTAMINATION.

TABLE 12

SUMMARY OF PHASE II SURFACE WATER SAMPLES

SAMPLE LOCATION	SOURCE	DATE SAMPLED	CONTAMINANTS DETECTED	CONCENTRATION (MICROGRAMS/LITER)
STATION 1	FISHING CREEK	ROUND 1 AUG/SEPT 1988	NONE	N/A
STATION 2	FISHING CREEK	ROUND 1 AUG/SEPT 1988	NONE	N/A
STATION 2 DUPLICATE	FISHING CREEK	ROUND 1 AUG/SEPT 1988	NONE	N/A
STATION 1	FISHING CREEK	ROUND 2 OCTOBER 1988	ACETONE	91.0
STATION 1 DUPLICATE	FISHING CREEK	ROUND 2 OCTOBER 1988	NONE	N/A
STATION 2	FISHING CREEK	ROUND 2 OCTOBER 1988	NONE	N/A

TABLE 13

POTENTIAL PATHWAYS FOR EXPOSURE AT THE CAROLAWN SITE

RELEASE MEDIUM	POTENTIAL RELEASE SOURCE	RELEASE MECHANISM	RELEASE TIME FRAME	RELEASE PROBABILITY/AMOUNT*
AIR	CONTAMINATED	FUGITIVE DUST	CHRONIC	LOW PROBABILITY/MINOR
	SURFACE SOIL	VOLATILIZATION	CHRONIC	LOW PROBABILITY/MINOR
SURFACE WATER	CONTAMINATED	SURFACE RUNOFF	CHRONIC	LOW PROBABILITY/MINOR
	SURFACE SOIL GROUNDWATER	GROUNDWATER		
GROUND- WATER	SURFACE SOILS	SITE LEACHING	CHRONIC	100% PROBABILITY/MINOR
SOIL	SURFACE SOILS	SITE LEACHING	CHRONIC	100% PROBABILITY/MINOR
	& WASTES	DIRECT CONTACT	EPISODIC	LOW PROBABILITY/MINOR

* - MINOR, MODERATE AND MAJOR REFER TO COMPARISON OF RELEASE
AT THIS SITE AND DO NOT ATTEMPT TO QUANTIFY THE

RELEASE.-53-

TABLE 14

SUMMARY OF POTENTIAL HUMAN EXPOSURE PATHWAYS

TRANSPORT MEDIUM	SOURCE	MECHANISM	POINT	HUMAN ROUTE
AIR	SURFACE SOIL	VOLATILIZATION AND DUST	NEARBY RESIDENCES (OFF-SITE)	INHALATION
			ON-SITE	INHALATION

SURFACE WATER	CONTAMINATED SURFACE SOIL	LEACHING SURFACE RUNOFF PONDS	RIVER RIVER	DERMAL FISHING INGESTION WATER INGESTION
GROUNDWATER	SURFACE SOIL & PONDS BURIED WASTES	LEACHING LEACHING	WELLS RIVER (SURFACE DISCHARGE)	INGESTION (SEE SURFACE WATER)
SOIL	SURFACE SOIL & WASTES	DIRECT CONTACT	ON-SITE OFF-SITE	INGESTION DERMAL INHALATION INGESTION DERMAL INHALATION

* ESTIMATED SIZE OF POPULATION INVOLVED AT SPECIFIC POINT OF EXPOSURE:

SMALL - LESS THAN 200
MEDIUM - 200 TO 2,000
LARGE - 2,000 TO 20,000
MAJOR - OVER 20,000

TABLE 14 (CONTINUED)

SUMMARY OF POTENTIAL HUMAN EXPOSURE PATHWAYS

TRANSPORT MEDIUM	POINT	HUMAN ROUTE	SIZE OF POPULATION EXPOSED*	PATHWAY COMPLETE
AIR	OFF-SITE	INHALATION	SMALL	NO
	ON-SITE	INHALATION	SMALL	NO
SURFACE WATER	RIVER	DERMAL	SMALL	YES
	RIVER	FISH INGESTION	SMALL	YES
		WATER INGESTION	NONE	NO

GROUNDWATER	WELLS	INGESTION	NONE	YES
	RIVER (SURFACE DISCHARGE)	(SEE SURFACE WATER)		YES
SOIL	ON-SITE	INGESTION	SMALL	NO
		DERMAL	SMALL	NO
		INHALATION	(SEE AIR ON-SITE)	
	ON-SITE	INGESTION DERMAL INHALATION	(SEE AIR OFF-SITE)	

* ESTIMATED SIZE OF POPULATION INVOLVED AT SPECIFIC POINT OF EXPOSURE:

SMALL - LESS THAN 200
MEDIUM - 200 TO 2,000
LARGE - 2,000 TO 20,000
MAJOR - OVER 20,000

TABLE 15

ESTIMATED HEALTH RISK DUE TO SITE RELATED CHEMICALS
BY CONSUMPTION OF GROUNDWATER FROM WELLS REPRESENTING
BOUNDARY LINE CONCENTRATIONS
CAROLAWN SITE - FORT LAWN, S.C.

CHEMICAL	WELL CONCENTRATION(1) (MG/L)			
	MW3	MW4	MW8	MW9
ACETONE	3.2E+00	4.57E+00	5.7E-02	3.28E+00
1,1,1-TCA	1.17E-01	9.20E-02	5.0E-03	3.8E-02
1,2-DCE	1.10E-01	3.75E-01	5.0E-03	7.4E-02
1,1-DCA	9.80-02	9.20E-02	5.0E-03	3.8E-02
1,1-DCE	1.24E-01	9.20E-02	5.0E-03	3.8E-02
TCE	4.30E-01	3.95E-01	5.0E-03	4.5E-02

NOTES:

- (1) MEAN CONCENTRATION BASED ON PHASE II (ROUND 1 AND 2) SAMPLING RESULTS (TABLE 6)
- (2) ADDED CANCER RISK - BASED ON ASSUMPTIONS AND FORMULA PRESENTED IN TABLE 1.
- (3) EXPOSURE/ACCEPTABLE INTAKE CHRONIC RATION - RATIO BELOW ONE (1) INDICATES NO HEALTH CONCERNS. EXPOSURE BASED ON ASSUMPTIONS IN TABLE 1.

1,1,1-TCA -- 1,1,1-TRICHLOROETHANE 1,1-DCA -- 1,1-DICHLOROETHANE
 1,1-DCE -- 1,1-DICHLOROETHENE 1,2-DCE -- 1,2-DICHLOROETHENE
 TCE -- TRICHLOROETHENE

TABLE 15 (CONTINUED)

ESTIMATED HEALTH RISK DUE TO SITE RELATED CHEMICALS
 BY CONSUMPTION OF GROUNDWATER FROM WELLS REPRESENTING
 BOUNDARY LINE CONCENTRATIONS
 CAROLAWN SITE - FORT LAWN, S.C.

ADDED CANCER(2)
 RISK FROM DRINKING

CHEMICAL	MW3	MW4	MW8	MW9
ACETONE	--	--	--	--
1,1,1-TCA	--	--	--	--
1,2-DCE	--	--	--	--
1,1-DCA	--	--	--	--
1,1-DCE	2.05E-03	1.52E-03	8.29E-05	6.30E-04
TCE	1.35E-04	1.24E-04	1.57E-06	1.41E-05
TOTALS	2.19E-03	1.64E-03	8.40E-05	6.44E-04

NOTES:

- (1) MEAN CONCENTRATION BASED ON PHASE II (ROUND 1 AND 2) SAMPLING RESULTS (TABLE 6)
- (2) ADDED CANCER RISK - BASED ON ASSUMPTIONS AND FORMULA PRESENTED IN TABLE 1.
- (3) EXPOSURE/ACCEPTABLE INTAKE CHRONIC RATION - RATIO BELOW ONE (1) INDICATES NO HEALTH CONCERNS. EXPOSURE BASED ON ASSUMPTIONS IN TABLE 1.

1,1,1-TCA -- 1,1,1-TRICHLOROETHANE 1,1-DCA -- 1,1-DICHLOROETHANE
 1,1-DCE -- 1,1-DICHLOROETHENE 1,2-DCE -- 1,2-DICHLOROETHENE
 TCE -- TRICHLOROETHENE

TABLE 15 (CONTINUED)

ESTIMATED HEALTH RISK DUE TO SITE RELATED CHEMICALS
 BY CONSUMPTION OF GROUNDWATER FROM WELLS REPRESENTING
 BOUNDARY LINE CONCENTRATIONS
 CAROLAWN SITE - FORT LAWN, S.C.

CHEMICAL	EXPOSURE/ADI (3)			
	MW3	MW4	MW8	MW9
ACETONE	9.21E-01	1.31E+00	1.63E-02	9.37E-01
1,1,1-TCA	6.19E-03	4.87E-03	2.65E-04	2.01E-03
1,2-DCE	5.82E-03	1.98E-02	2.65E-04	3.92E-03
1,1-DCA	2.33E-03	2.19E-03	1.19E-04	9.05E-04
1,1-DCE	--	--	--	--
TCE	--	--	--	--
TOTALS	9.35E-01	1.34E+00	1.70E-02	9.44E-01

NOTES:

- (1) MEAN CONCENTRATION BASED ON PHASE II (ROUND 1 AND 2) SAMPLING RESULTS (TABLE 6)
- (2) ADDED CANCER RISK - BASED ON ASSUMPTIONS AND FORMULA PRESENTED IN TABLE 1.
- (3) EXPOSURE/ACCEPTABLE INTAKE CHRONIC RATION - RATIO BELOW ONE (1) INDICATES NO HEALTH CONCERNS. EXPOSURE BASED ON ASSUMPTIONS IN TABLE 1.

1,1,1-TCA -- 1,1,1-TRICHLOROETHANE 1,1-DCA -- 1,1-DICHLOROETHANE
 1,1-DCE -- 1,1-DICHLOROETHENE 1,2-DCE -- 1,2-DICHLOROETHENE
 TCE -- TRICHLOROETHENE

TABLE 16

PROJECTED POTENTIAL FUTURE HEALTH IMPACT
 FROM CONSUMPTION OF CONTAMINATED GROUNDWATER
 CAROLAWN SITE, FORT LAWN
 SOUTH CAROLINA

COMPOUND	CREEK CONCENTRATION(1) (MG/L)	CHEMICAL EXPOSURE(2) (MG/KG/DAY)	CPF (MG/KG/DAY)(1)
ACETONE	6.52	0.179	
1,1-DICHLOROETHANE	5.0 X 10(-3)	1.43 X 10(-4)	
1,1-DICHLOROETHENE	9.0 X 10(-2)	2.57 X 10(-3)	5.80 X 10(-1)
1,2-DICHLOROETHENE	3.4 X 10(-1)	9.71 X 10(-3)	
1,1,1-TRICHLOROETHANE	3.6 X 10(-2)	1.03 X 10(-3)	
TRICHLOROETHENE	7.9 X 10(-1)	2.26 X 10(-2)	1.10 X 10(-2)

- (1) AS DEVELOPED IN SECTION 6 OF THE RI REPORT.
- (2) ASSUMES CONSUMPTION OF 2.0 L GROUNDWATER PER DAY BY 70 KG ADULT.
- (3) BASED ON PMCL OF 70 UG/L AS GIVEN IN 54 CFR 22062; MAY 22, 1989.

TABLE 16 (CONTINUED)

PROJECTED POTENTIAL FUTURE HEALTH IMPACT
FROM CONSUMPTION OF CONTAMINATED GROUNDWATER
CAROLAWN SITE, FORT LAWN
SOUTH CAROLINA

COMPOUND	ADI (MG/KG/DAY)	RISK	EXPOSURE/ ADI
ACETONE	1.00 X 10 ⁽⁻¹⁾		1.79
1,1-DICHLOROETHANE	1.20 X 10 ⁽⁻¹⁾		1.19 X 10 ⁽⁻³⁾
1,1-DICHLOROETHENE		1.49 X 10 ⁽⁻³⁾	
1,2-DICHLOROETHENE	2.0 X 10 ⁽⁻²⁾ (3)		
1,1,1-TRICHLOROETHANE	5.40 X 10 ⁽⁻¹⁾		1.91 X 10 ⁽⁻³⁾
TRICHLOROETHENE		2.48 X 10 ⁽⁻⁴⁾	1.10 X 10 ⁽⁻²⁾

- (1) AS DEVELOPED IN SECTION 6 OF THE RI REPORT.
 (2) ASSUMES CONSUMPTION OF 2.0 L GROUNDWATER PER DAY BY 70 KG ADULT.
 (3) BASED ON PMCL OF 70 UG/L AS GIVEN IN 54 CFR 22062; MAY 22, 1989.

TABLE 17

PHASE I GROUNDWATER LEAD CONCENTRATIONS
CAROLAWN SITE - FORT LAWN, SOUTH CAROLINA

SAMPLING DATE	MW-1	MW-2	MW-3	MW-4	RW-1	RW-2	RW-3	RW-4
7/86	23	27	26	26	20	4	4	2.6
7/86		28						
12/86	4	10	4		4	14		

MONITORING WELL MEAN: 19 UG/L
(ND = DL = UG/L)

RESIDENTIAL WELL MEAN: 9 UG/L
(ND = DL = 5 UG/L)

NOTES:

- (1) THIS TABLE SUMMARIZES LEAD CONCENTRATIONS GIVEN IN TABLE 5.
(2) DETECTION LIMIT = 5.0 UG/L

TABLE 18

ASSUMPTIONS FOR ESTIMATING EXPOSURE AND
RISK FROM SWIMMING IN FISHING CREEK
CAROLAWN SITE - FORT LAWN, SOUTH CAROLINA

ASSUMPTION	OLDER CHILD 6 TO 18 YEARS	ADULT 19 TO 70 YEARS
YEARS EXPOSED	12	35
BODY WEIGHT (KG)	21	70
SWIM EPISODES:		
O TIMES/MONTH	20	20
O MONTHS/YEAR	5	5
AREA OF BODY EXPOSED(CM(2))(2)	9,400	18,000
ABSORPTION RATE (WATER)(3)	2MG/CM(2)/SWIM	2MG/CM(2)/SWIM
PERCENT CHEMICAL ABSORPTION(3)		
O NON-CARCINOGENS (%)	1	1
O CARCINOGENS (%)	50	50
LIFE EXPECTANCY (YEARS)	70	70

CALCULATION TO DETERMINE EXPOSURE FOR A CARCINOGEN:

$C \times WA(1) \times A \times AF \times TIME \times U.F.$
CE= -----

BW X DAYS/YEAR X YEARS

WHERE:

CE	=	CHEMICAL EXPOSURE(MG/KG/DAY)
C	=	WATER CONCENTRATION(MG/L)
WA	=	WATER ABSORPTION RATE(MG/CM(2)/SWIM)
A	=	AREA OF THE SURFACE OF THE BODY(CM(2))
TIME	=	NUMBER OF DAYS EXPOSED PER YEAR X NUMBER OF YEARS INDIVIDUAL SWIMS
		1L
U.F.	=	-----
		1000 ML
BW	=	BODY WEIGHT (KG)
DAYS/YEAR	=	365 DAYS
YEARS	=	LENGTH OF LIFETIME (70 YEARS)

CALCULATIONS OF EXPOSURE FOR A NON-CARCINOGEN ASSUMES THE INDIVIDUAL SWIMS 5 TIMES PER WEEK.

THE ADDITIONAL RISK OF CANCER WAS CALCULATED USING THE FOLLOWING FORMULA:

R	=	CE X PF
---	---	---------

WHERE:

R	=	LIFETIME ADDITIONAL RISK OF CANCER FROM EXPOSURE CE
CE	=	CHEMICAL EXPOSURE (MG/KG/DAY)
PF	=	CANCER POTENCY FACTOR (MG/KG/DAY)(-1), SUPERFUND PUBLIC HEALTH EVALUATION MANUAL, APPENDIX C, EXHIBIT C-4

NOTE:

- (1) WATER-BORNE CHEMICALS ARE ASSUMED TO BE DERMALLY ABSORBED AT A RATE EQUAL TO THAT OF WATER. THIS IS SUPPORTED IN CHAPTER 6 OF THE SUPERFUND EXPOSURE ASSESSMENT MANUAL.
- (2) SUPERFUND EXPOSURE ASSESSMENT MANUAL, APRIL 1988, EPA/540/1-88/001.
- (3) HAWLEY, J.K. (1985) RISK ANALYSIS. 5 NO. 4, P. 295.

TABLE 19

ESTIMATED HEALTH RISK
FOR SWIMMING IN FISHING CREEK
CAROLAWN SITE - FORT LAWN, SOUTH CAROLINA

CHEMICAL	RIVER(1) CFS	CONC. IN(2) CREEK-MG/L	ADDED(3) CANCER RISK	EXPOSURE/AIC(4)
ACETONE	7	1.40E-03	NC	6.27E-08
	45	2.00E-04	NC	8.95E-08
1,1-DICHLOROETHANE	7	1.00E-06	NC	3.73E-11
	45	2.00E-07	NC	7.46E-12
1,1-DICHLOROETHENE	7	2.00E-05	4.09E-10	NA
	45	3.00E-06	6.13E-11	NA
1,2-DICHLOROETHENE	7	8.00E-05	NC	6.63E-09
	45	1.00E-05	NC	8.29E-10
1,1,1-TRICHLOROETHANE	7	8.00E-06	NC	6.27E-07
	45	1.00E-06	NC	8.29E-11
TRICHLOROETHENE	7	1.80E-04	6.97E-11	NA
	45	3.00E-05	1.16E-11	NA
TOTALS	7		4.78E-10	6.34E-07
	45		7.29E-11	9.04E-08

(1) CREEK FLOW ON WHICH GROUNDWATER DILUTION IS BASED.

(2) CONCENTRATION ESTIMATE IN CREEK BASED ON GROUNDWATER AND CONCENTRATION ESTIMATES. SEE SECTION 6 OF THE RI REPORT.

(3) ADDED CANCER RISK - BASED ON ASSUMPTIONS AND FORMULA PRESENTED IN TABLE 18.

(4) EXPOSURE/ACCEPTABLE INTAKE CHRONIC RATIO. RATION BELOW ONE (1) INDICATES NO HEALTH CONCERNS. EXPOSURE BASED ON ASSUMPTIONS IN TABLE 18.

TABLE 20

ASSUMPTIONS FOR FISH INGESTION SCENARIO

CAROLAWN SITE
FORT LAWN, SOUTH CAROLINA

CHEMICAL	BIOCONCENTRATION FACTOR (BCF) (1/KG)	NON-CARCINOGEN	CARCINOGEN
		ACCEPTABLE	UNIT
		DAILY	CANCER
		INTAKE (ADI) (MG/KG/DAY)	RISK (UCR) (MG/KG/DAY) (-1)
ACETONE	NA	1.00E-01	NA
1,1-DICHLOROETHENE	5.6	9.00E-03	5.80 X 10(-1)
1,2-DICHLOROETHENE	NA	1.20E-01	NA
1,2-DICHLOROETHENE	CIS - 1.6	CIS - 2.0E - 03*	NA
	TRANS - 1.6	TRANS - 2.9E - 03*	NA
1,1,1-TRICHLOROETHANE	5.6	5.40E-01	NA
TRICHLOROETHENE	10.6	NA	1.10E-02
LEAD	49	1.40E-03	NA

QUALITY OF FISH CONSUMED PER DAY:

AVERAGE INTAKE (CHRONIC)	14 GRAMS
MAXIMUM INTAKE	42 GRAMS

LIFETIME	70 YEARS
----------	----------

AVERAGE BODY WEIGHT	70 KG
---------------------	-------

* BASED ON EPA PROPOSED MCLS IN 54 FR 22062; MAY 22, 1989 FOR
1,2-DICHLOROETHENE, 2.0L WATER CONSUMPTION PER DAY, 70 KG TOTAL BODY
MASS.

TABLE 21

ESTIMATED HEALTH RISK
FROM EATING FISH FROM FISHING CREEK
CAROLAWN SITE - FORT LAWN, SOUTH CAROLINA

CHEMICAL	FLOW(1) CFS	CONC. IN(2) CREEK-MG/L	ADDED CANCER RISK(3)	
			LO INTAKE	HI INTAKE
ACETONE	7	1.40E-03	NC	NC
	45	2.00E-04	NC	NC
1,1-DICHLOROETHANE	7	1.00E-06	NC	NC
	45	2.00E-07	NC	NC
1,1-DICHLOROETHENE	7	2.00E-05	1.30E-8	3.90E-08
	45	3.00E-06	1.95E-09	5.85E-09
1,2-DICHLOROETHENE	7	8.00E-05	NC	NC
	45	1.00E-05	NC	NC
1,1,1-TRICHLOROETHANE	7	8.00E-06	NC	NC
	45	1.00E-06	NC	NC
TRICHLOROETHENE	7	1.80E-04	4.20E-09	1.26E-08
	45	3.00E-05	7.00E-10	2.10E-09
TOTALS	7		1.72E-08	5.16E-08
	45		2.65E-09	7.95E-09

(1) CREEK FLOW ON WHICH GROUNDWATER DILUTION IS BASED.

(2) CONCENTRATION ESTIMATE IN CREEK BASED ON GROUNDWATER AND CONCENTRATION ESTIMATES. SEE SECTION 6 OF THE RI REPORT.

(3) ADDED CANCER RISK - BASED ON ASSUMPTIONS PRESENTED IN TABLE 1 THAT INDIVIDUAL EATS THE DESIGNATED QUANTITY OF FISH (LO-14 GRAMS PER DAY; HI-42 GRAMS PER DAY) FOR 70 YEARS LIFETIME.

(4) EXPOSURE/ACCEPTABLE INTAKE RATIO. IF RATIO IS LESS THAN ONE (1) THERE IS NO HEALTH CONCERN. INTAKE IS BASED ON SAME LEVEL OF FISH CONSUMPTION NOTED IN NOTE(3) ABOVE.

TABLE 21(CONTINUED)

ESTIMATED HEALTH RISK
FROM EATING FISH FROM FISHING CREEK
CAROLAWN SITE - FORT LAWN, SOUTH CAROLINA

CHEMICAL	FLOW(1)	CONC. IN(2)	EXPOSURE/AIC(4)	
	CFS	CREEK-MG/L	LO INTAKE	HI INTAKE
ACETONE	7	1.40E-03	2.80E-06	8.40E-06
	45	2.00E-04	4.00E-07	1.20E-06
1,1-DICHLOROETHANE	7	1.00E-06	2.00E-10	6.00E-10
	45	2.00E-07	4.00E-07	1.20E-10
1,1-DICHLOROETHENE	7	2.00E-05	NA	NA
	45	3.00E-06	NA	NA
1,2-DICHLOROETHENE	7	8.00E-05	4.74E-08	1.42E-07
	45	1.00E-05	5.98E-09	1.78E-08
1,1,1-TRICHLOROETHANE	7	8.00E-06	1.66E-08	4.98E-08
	45	1.00E-06	2.07E-09	6.22E-09
TRICHLOROETHENE	7	1.80E-04	NA	NA
	45	3.00E-05	NA	NA
TOTALS	7		2.86E-06	8.59E-06
	45		4.08E-07	1.22E-06

(1) CREEK FLOW ON WHICH GROUNDWATER DILUTION IS BASED.

(2) CONCENTRATION ESTIMATE IN CREEK BASED ON GROUNDWATER AND CONCENTRATION ESTIMATES. SEE SECTION 6 OF THE RI REPORT.

(3) ADDED CANCER RISK - BASED ON ASSUMPTIONS PRESENTED IN TABLE 1 THAT INDIVIDUAL EATS THE DESIGNATED QUANTITY OF FISH (LO-14 GRAMS PER DAY; HI-42 GRAMS PER DAY) FOR 70 YEARS LIFETIME.

(4) EXPOSURE/ACCEPTABLE INTAKE RATIO. IF RATIO IS LESS THAN ONE (1) THERE IS NO HEALTH CONCERN. INTAKE IS BASED ON SAME LEVEL OF FISH CONSUMPTION NOTED IN NOTE(3) ABOVE.

TABLE 22

CHEMICAL SPECIFIC ARARS
CAROLAWN SITE, FORT LAWN, SOUTH CAROLINA
UG/L

	MCL(2)	PMCL(5)	WQC(1)	PMCLG(6)
ACETONE	NA	700(6)	3,500*	NA
1,1-DICHLOROETHANE	NA	NA	4,200*	NA
1,2-DICHLOROETHENE	NA	NA	350(4)	CIS-70 TRANS-100
1,1-DICHLOROETHENE	7	NA	0.033	NA
1,1,1-TRICHLOROETHANE	200	NA	18,400	NA
TRICHLOROETHENE	5	NA	2.7	NA
LEAD	50	5(8)	50	0(8)

(1) WQC - WATER QUALITY CRITERIA - FR VOL. 45, NO. 231, NOV. 28, 1980. FOR PROTECTION OF HUMAN HEALTH FROM DRINKING WATER AND AQUATIC FOOD. CARCINOGENS - 1×10^{-6} ADDED LIFETIME RISK. *DEVELOPED BY APPLICATION OF AIC LIMIT, EXHIBIT A-6 OF THE SUPERFUND PUBLIC HEALTH EVALUATION MANUAL. ASSUME 70 KG MAN DRINKS 2 LITER PER DAY.

(2) MCL - MAXIMUM CONCENTRATION LIMITS. THE MANUAL EXHIBIT 4-5 AND FR VOL. 52, NO. 135, JULY 8, 1987.

NA = NOT AVAILABLE

(3) CRITERIA FOR PROTECTION OF AQUATIC LIFE (FRESHWATER) FR VOL. 45, NO. 231, NOV. 28, 1980. IF NOT AVAILABLE IN FR REFERENCE, CALCULATED AT 1/10TH THE 96 HOUR LC (50) AS REPORTED IN VERSCHIEREN, HANDBOOK OF ENVIRONMENTAL DATA ON ORGANIC CHEMICALS, 2ND EDITION, VANNOSTRAND RHEINHOLD COMPANY, NEW YORK, 1983.

(4) EPA DRINKING WATER HEALTH ADVISORIES - LIFETIME. EXHIBIT 4-8. THE MANUAL.

(5) PROPOSED MAXIMUM CONTAMINANT LEVEL. EPA PROPOSED NATIONAL PRIMARY AND SECONDARY DRINKING WATER REGULATIONS. 54 FR 22062; MAY 22, 1989.

(6) PROPOSED MAXIMUM CONTAMINANT LEVEL GOALS. EPA PROPOSED NATIONAL PRIMARY AND SECONDARY DRINKING WATER REGULATIONS 54 FR 22062; MAY

22, 1989.

(7) CRITERION AT 100 UG/L HARDNESS AS CaCO₃.

(8) EPA PROPOSED MCLGS AND NATIONAL PRIMARY DRINKING WATER REGULATIONS FOR LEAD AND COPPER. 53 FR 31516; AUGUST 18, 1988.

TABLE 22 (CONTINUED)

CHEMICAL SPECIFIC ARARS
CAROLAWN SITE, FORT LAWN, SOUTH CAROLINA
UG/L

AQUATIC LIFE(3)

ACETONE	610,000
1,1-DICHLOROETHANE	55,000
1,2-DICHLOROETHENE	22,000
1,1-DICHLOROETHENE	58,000
1,1,1-TRICHLOROETHANE	58,000
TRICHLOROETHENE	4,070
LEAD	3.8(7)

(1) WQC - WATER QUALITY CRITERIA - FR VOL. 45, NO. 231, NOV. 28, 1980. FOR PROTECTION OF HUMAN HEALTH FROM DRINKING WATER AND AQUATIC FOOD. CARCINOGENS - 1×10^{-6} ADDED LIFETIME RISK. *DEVELOPED BY APPLICATION OF AIC LIMIT, EXHIBIT A-6 OF THE SUPERFUND PUBLIC HEALTH EVALUATION MANUAL. ASSUME 70 KG MAN DRINKS 2 LITER PER DAY.

(2) MCL - MAXIMUM CONCENTRATION LIMITS. THE MANUAL EXHIBIT 4-5 AND FR VOL. 52, NO. 135, JULY 8, 1987.

NA = NOT AVAILABLE

(3) CRITERIA FOR PROTECTION OF AQUATIC LIFE (FRESHWATER) FR VOL. 45, NO. 231, NOV. 28, 1980. IF NOT AVAILABLE IN FR REFERENCE, CALCULATED AT 1/10TH THE 96 HOUR LC(50) AS REPORTED IN VERSCHIEREN, HANDBOOK OF ENVIRONMENTAL DATA ON ORGANIC CHEMICALS, 2ND EDITION, VANNOSTRAND

RHEINHOLD COMPANY, NEW YORK, 1983.

- (4) EPA DRINKING WATER HEALTH ADVISORIES - LIFETIME. EXHIBIT 4-8. THE MANUAL.
- (5) PROPOSED MAXIMUM CONTAMINANT LEVEL. EPA PROPOSED NATIONAL PRIMARY AND SECONDARY DRINKING WATER REGULATIONS. 54 FR 22062; MAY 22, 1989.
- (6) PROPOSED MAXIMUM CONTAMINANT LEVEL GOALS. EPA PROPOSED NATIONAL PRIMARY AND SECONDARY DRINKING WATER REGULATIONS 54 FR 22062; MAY 22, 1989.
- (7) CRITERION AT 100 UG/L HARDNESS AS CaCO₃.
- (8) EPA PROPOSED MCLGS AND NATIONAL PRIMARY DRINKING WATER REGULATIONS FOR LEAD AND COPPER. 53 FR 31516; AUGUST 18, 1988.

TABLE 23

CLEANUP GOALS FOR THE CONTAMINANTS FOUND
AT THE CAROLAWN SUPERFUND SITE
LEVELS ARE IN MICROGRAMS/LITER (UG/L)

CHEMICAL	CLEANUP GOAL	BASIS FOR CLEANUP GOAL
ACETONE	700	+
1,1-DICHLOROETHANE	*	*
1,1-DICHLOROETHENE	7	MCL
1,2-DICHLOROETHENE	70 - CIS 100 - TRANS	PROPOSED MCL PROPOSED MCL
1,1,1-TRICHLOROETHANE	200	MCL
TRICHLOROETHENE	5	MCL
LEAD	5	PROPOSED MCL

+ - THE VALUE OF 700 PPB FOR ACETONE IS A LIFETIME HEALTH ADVISORY

(LHA).

- * - NO FIRM CLEANUP CRITERIA HAS BEEN ESTABLISHED BUT IT IS ASSUMED THAT DUE TO 1,1-DICHLOROETHANE SIMILAR CHEMICAL/PHYSICAL CHARACTERISTICS WITH THE OTHER CONTAMINANTS PRESENT, THE LEVELS WILL DECREASE PROPORTIONALLY ALONG WITH THE OTHER CONTAMINANTS.

TABLE 24

GROUNDWATER REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS
CAROLAWN SITE, FORT LAWN, SOUTH CAROLINA

APPLICABLE RESPONSE ACTION	REMEDIAL TECHNOLOGY	PROCESS OPTION
ALTERNATE WATER SUPPLY	<ul style="list-style-type: none">O CONNECTION OF FUTURE USERS TO MUNICIPAL WATER SUPPLY	<ul style="list-style-type: none">O CONNECT TO EXISTING SUPPLY LINEO CONNECT TO A NEW SUPPLY LINE TO BE CONSTRUCTED
GROUNDWATER EXTRACTION	<ul style="list-style-type: none">O EXTRACTION OF CONTAMINATED GROUNDWATER FROM BEDROCK AQUIFER	<ul style="list-style-type: none">O PUMPED EXTRACTION WELLSO PIPE AND MEDIA DRAIN
CONTAINMENT	<ul style="list-style-type: none">O HYDRAULIC CONTAINMENT BY EXTRACTIONO PHYSICAL CONTAINMENT	<ul style="list-style-type: none">O PUMPED EXTRACTION WELLSO PIPE AND MEDIA DRAINO GROUT CURTAIN
GROUNDWATER TREATMENT	<ul style="list-style-type: none">O BIOLOGICALO ACTIVATED CARBON	<ul style="list-style-type: none">O ACTIVATED SLUDGEO AEROBIC/FACULTATIVE LAGOONSO FIXED FILM SYSTEMSO GRANULAR ACTIVATED CARBON (GAC)

			O POWDERED ACTI- VATED CARBON (PAC)
	O AIR STRIPPING		O PACKED TOWER STRIPPER
			O AERATION BASIN
	O OXIDATION		
	O ION EXCHANGE		
	O REVERSE OSMOSIS		
	O EVAPORATION	O SOLAR EVAPORA- TION	
		O SPRAY EVAPORA- TION	
	O DISPOSAL TO POTW FOR TREATMENT	O FORCEMAIN	
	O DISPOSAL AT A RCRA FACILITY	O BULK TRANSPOR- TATION BY TANKER TRUCK	
GROUNDWATER DISPOSAL	O REINJECTION	O INJECTION WELLS	
	O DISCHARGE TO POTW		
	O DISCHARGE TO SURFACE WATERS		
	O DISPOSAL AT A RCRA FACILITY		

TABLE 25

SCREENING OF GROUNDWATER REMEDIAL TECHNOLOGIES
CAROLAWN SITE, FORT LAWN, SOUTH CAROLINA

REMEDIAL TECHNOLOGY	APPLICABLE AS A REMEDIAL ALTERNATIVE COMPONENT	COMMENTS
1. ALTERNATIVE WATER SUPPLY		
O CONNECT TO EXISTING SUPPLY	NO	EXISTING COMMUNITY ALREADY CONNECTED. EXISTING LINE DOES NOT HAVE SUFFICIENT

		CAPACITY FOR FUTURE CONNECTIONS.
O CONNECT TO A NEW SUPPLY TO BE CONSTRUCTED	YES	PROVIDES SUFFICIENT CAPACITY FOR FUTURE CONNECTIONS.
2. GROUNDWATER EXTRACTION		
O EXTRACTION WELLS	YES	COLLECTS GROUNDWATER AND PREVENTS FUTURE MIGRATION. WILL REDUCE LEVELS OF CONTAMINATION OVER TIME. MAY BE INEFFECTIVE IN LOW PERMEABILITY SOILS OR COMPETENT ROCK.
O PIPE AND MEDIA DRAIN	NO	DIFFICULT AND COSTLY TO CONSTRUCT.
3. CONTAINMENT		
O HYDRAULIC CONTAINMENT BY EXTRACTION	YES	EFFECTIVELY SAME REMEDIAL TECHNOLOGY AS GROUNDWATER EXTRACTION.
O PHYSICAL CONTAINMENT BY GROUT CURTAIN	NO	DIFFICULT TO IMPLEMENT WHERE COMPETENCE OF BEDROCK IS VARIABLE. COSTLY TO CONSTRUCT. EFFECTIVENESS IS TYPICALLY POOR FOR BEDROCK WITH VARIABLE COMPETENCE.
4. GROUNDWATER TREATMENT		
O BIOLOGICAL		
I) ACTIVATED SLUDGE	NO	DIFFICULT TO SUSTAIN PROCESS WITH LOW LEVELS OF HYDROCARBON FEED FROM GROUND WATER ENVIRONMENT.
II) AEROBIC/FACULTATIVE LAGOONS	YES	MICROBIAL COMMUNITY VARIED AND MORE CAPABLE OF BEING SELF-SUSTAINING WITH LOW LEVELS OF HYDROCARBON FEED FROM GROUNDWATER.

III) FIXED FILM SYSTEMS	NO	SAME LIMITATIONS AS FOR ACTIVATED SLUDGE.
O ACTIVATED CARBON (GAC OR PAC)	YES	EFFECTIVE IN TREATING LARGE ARRAY OF ORGANIC CONTAMINANTS. CAN BE USED AS PRIMARY TREATMENT OR AS POLISHER IN COMBINATION WITH OTHER TREATMENT TECHNOLOGIES.
O AIR STRIPPING		
I) PACKED TOWER STRIPPER	YES	EFFECTIVE IN REMOVING VOLATILE COMPOUNDS. MAY REQUIRE PRETREATMENT OR ADDITIONAL POLISHING BY OTHER TECHNOLOGY. MOST EFFECTIVE FOR HIGH CONCENTRATION OF VOLATILES.
II) AERATION BASIN	YES	EFFECTIVE IN REMOVING VOLATILE COMPOUNDS. DOES NOT REQUIRE PRETREATMENT. MAY REQUIRE ADDITIONAL POLISHING BY OTHER TECHNOLOGY. EFFECTIVE FOR LOW CONCENTRATIONS OF VOLATILES.
O OXIDATION	NO	NOT EFFECTIVE IN TREATING CONTAMINANTS FOUND DURING WASTE CHARACTERIZATION AT THIS SITE.
O ION EXCHANGE	NO	USED TO TREAT INORGANIC WASTES (I.E. METALS), THEREFORE, NOT APPLICABLE AT THIS SITE.
O REVERSE OSMOSIS	NO	USED TO TREAT INORGANIC WASTE (I.E. METALS), AND HIGH MOLECULAR WEIGHT ORGANICS THEREFORE, NOT GENERALLY APPLICABLE AT THIS SITE. ALSO, HIGHLY SUBJECT TO FOULING BY PRECIPITATES AND BIOLOGICAL GROWTH.
O EVAPORIZATION		

I)	SOLAR EVAPORIZATION	NO	MAY BE EFFECTIVE IN TREATING VOLATILE COMPOUNDS ESPECIALLY DURING SUMMER MONTHS. EFFECTIVENESS IS DIFFICULT TO EVALUATE.
II)	SPRAY EVAPORIZATION	NO	MAY BE EFFECTIVE IN TREATING VOLATILE COMPOUNDS, ESPECIALLY DURING SUMMER MONTHS. PRESENCE OF OTHER NON-VOLATILE COMPOUNDS MAY RESTRICT USE OF THIS TECHNOLOGY. EFFECTIVENESS IS DIFFICULT TO EVALUATE.
O	DISCHARGE TO POTW FOR TREATMENT	YES	WOULD BE RESTRICTED BY OPERATING PERMIT OF POTW.
O	DISPOSAL AT A RCRA FACILITY FOR TREATMENT	NO	DIFFICULT TO IMPLEMENT AND MAINTAIN IN LONG TERM. COST PROHIBITIVE.
5. GROUNDWATER DISPOSAL			
O	REINJECTION	NO	INJECTION OF CONTAMINANTS TO A CLASS GB AQUIFER IS PROHIBITED.
O	DISPOSAL AT A RCRA FACILITY	NO	DIFFICULT TO IMPLEMENT AND MAINTAIN IN LONG TERM. COST PROHIBITIVE. NOT COST-EFFECTIVE IF GROUNDWATER TREATED ON-SITE.
O	DISCHARGE TO SURFACE WATER	YES	COST EFFECTIVE. GROUNDWATER MUST MEET SURFACE WATER CRITERIA PRIOR TO DISCHARGE.
O	DISCHARGE TO POTW	YES	WOULD BE RESTRICTED BY OPERATING PERMIT OF POTW. MAY NOT BE REQUIRED IF GROUNDWATER TREATED ON-SITE.

TABLE 26

ASSEMBLED REMEDIAL ALTERNATIVES FOR DETAILED ANALYSIS
CAROLAWN SITE, FORT LAWN, SOUTH CAROLINA

ALTERNATIVE NO.	ALTERNATIVE DESCRIPTION	REMEDIAL COMPONENTS
1.	NO ACTION	<ul style="list-style-type: none"> O INSTITUTIONAL DEED RESTRICTION O LONG TERM MONITORING
2.	ALTERNATE WATER SUPPLY	<ul style="list-style-type: none"> O INSTITUTIONAL DEED RESTRICTION O LONG TERM MONITORING O CONSTRUCTION OF NEW WATER SUPPLY LINE TO SERVICE ADJACENT AREAS FOR FUTURE DEVELOPMENT
3.	GROUNDWATER EXTRACTION WITH DISCHARGE TO POTW	<ul style="list-style-type: none"> O INSTITUTIONAL DEED RESTRICTION O LONG TERM MONITORING O INSTALLATION OF GROUNDWATER EXTRACTION SYSTEM O CONSTRUCTION OF DISCHARGE LINE TO POTW COLLECTION SYSTEM O EXTRACTION WITH DIRECT DISCHARGE TO POTW SYSTEM
4.	GROUNDWATER EXTRACTION WITH TREATMENT (AERATION) AND DISCHARGE TO FISHING CREEK	<ul style="list-style-type: none"> O INSTITUTIONAL DEED RESTRICTION O LONG TERM MONITORING O INSTALLATION OF GROUNDWATER EXTRACTION SYSTEM O INSTALLATION OF AERATION TREATMENT SYSTEM O EXTRACTION WITH TREATED DISCHARGE TO FISHING CREEK
5.	GROUNDWATER EXTRACTION WITH BIOLOGICAL TREATMENT AND DISCHARGE TO FISHING CREEK	<ul style="list-style-type: none"> O INSTITUTIONAL DEED RESTRICTION O LONG TERM MONITORING O INSTALLATION OF GROUNDWATER EXTRACTION SYSTEM O CONSTRUCTION OF AEROBIC/FACULTATIVE LAGOONS O EXTRACTION WITH TREATED DISCHARGE TO FISHING CREEK

TABLE 27

DETAILED ANALYSIS CRITERIA AND FACTORS

EVALUATION CRITERIA

EVALUATION FACTORS

THRESHOLD CRITERIA

OVERALL PROTECTION OF
HUMAN HEALTH AND THE
ENVIRONMENT

* ELIMINATION, REDUCTION, OR CONTROL OF
RISKS

COMPLIANCE WITH
APPLICABLE OR
RELEVANT AND
APPROPRIATE REQUIREMENTS

* COMPLIANCE WITH CONTAMINANT-SPECIFIC
ARARS
* COMPLIANCE WITH ACTION-SPECIFIC
* COMPLIANCE WITH LOCATION-SPECIFIC

PRIMARY BALANCING CRITERIA

LONG-TERM EFFECTIVENESS
AND PERMANENCE;

* MAGNITUDE OF RESIDUAL RISK
* ADEQUACY OF CONTROLS
* RELIABILITY OF CONTROLS

REDUCTION OF TOXICITY,
MOBILITY, OR VOLUME;

* TREATMENT PROCESS USED AND MATERIALS
TREATED
* AMOUNT OF HAZARDOUS MATERIALS
DESTROYED OR TREATED
* TYPE AND QUANTITY OF RESIDUALS
REMAINING AFTER TREATMENT
* DEGREE OF EXPECTED REDUCTIONS IN
TOXICITY, MOBILITY, AND VOLUME
* DEGREE TO WHICH TREATMENT IS
IRREVERSIBLE

SHORT-TERM EFFECTIVENESS

* PROTECTION OF COMMUNITY DURING
REMEDIAL ACTION
* PROTECTION OF WORKERS DURING REMEDIAL
ACTION
* TIME UNTIL OBJECTIVES AND PROTECTION
ARE ACHIEVED
* ENVIRONMENTAL IMPACTS

IMPLEMENTABILITY

* TECHNICAL FEASIBILITY
* ADMINISTRATIVE FEASIBILITY
* AVAILABILITY OF SERVICES AND MATERIALS

COSTS

* TOTAL CAPITAL COSTS
* OPERATING AND MAINTENANCE COSTS
* TOTAL PRESENT WORTH COST AT 5 PERCENT

EVALUATION CRITERIA

MODIFYING CRITERIA

STATE/SUPPORT AGENCY	*	LEVEL OF COMMUNITY ACCEPTANCE
	*	SPECIFIC COMMENTS OF STATE
	*	IMPACT OF THE SELECTED REMEDY ON THE STATE AND THE COMMUNITY
COMMUNITY ACCEPTANCE	*	LEVEL OF COMMUNITY ACCEPTANCE
	*	SPECIFIC COMMENTS FROM THE COMMUNITY
	*	IMPACT OF THE SELECTED REMEDY ON THE COMMUNITY

TABLE 28

COST SENSITIVITY ANALYSIS
10 YR VS. 30 YR DURATION

CAROLAWN SITE, FORT LAWN, SOUTH CAROLINA

ALTERNATIVE	10 YEAR PERIOD			PERCENT
	CAPITAL COST	O&M COST	TOTAL COST	INCREASE IN TOTAL COST
1) NO ACTION	\$0	\$331,914	\$331,914	0%
2) ALTERNATIVE WATER SUPPLY	\$243,750	\$331,914	\$575,664	0%
3) DIRECT DISCHARGE TO POTW	\$802,670	\$553,635	\$1,356,305	15%
4) AERATION AND TREATMENT TO FISHING CREEK	\$504,807	\$636,264	\$1,141,071	23%
5) FACULTATIVE LAGOON TREATMENT AND DISCHARGE TO FISHING CREEK	\$525,931	\$645,833	\$1,171,764	23%

TABLE 28 (CONTINUED)

COST SENSITIVITY ANALYSIS
10 YR VS. 30 YR DURATION

CAROLAWN SITE, FORT LAWN, SOUTH CAROLINA

ALTERNATIVE	30 YEAR PERIOD			PERCENT
	CAPITAL COST	O&M COST	TOTAL COST	INCREASE IN TOTAL COST
1) NO ACTION	\$0	\$331,914	\$331,914	0%
2) ALTERNATIVE WATER SUPPLY	\$243,750	\$331,914	\$575,664	0%
3) DIRECT DISCHARGE TO POTW	\$802,669	\$753,433	\$1,556,102	15%
4) AERATION AND TREATMENT TO FISHING CREEK	\$504,806	\$898,828	\$1,403,634	23%
5) FACULTATIVE LAGOON TREATMENT AND DISCHARGE TO FISHING CREEK	\$525,931	\$916,723	\$1,442,654	23%

TABLE 30

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

LAW, REGULATION,
POLICY AND STANDARD

APPLICATION

RESOURCE CONSERVATION AND RECOVERY ACT (RCRA)

NONE

CLEAN WATER ACT (CWA)

40 CFR 122, 125:
NATIONAL POLLUTANT DISCHARGE
ELIMINATION SYSTEMS (NPDES)

DISCHARGES OF EXTRACTED/TREATED
GROUNDWATER WILL BE SUBJECT TO
SUBSTANTIVE REQUIREMENTS OF THE
NPDES PROCESS IF DISCHARGED TO
LOCAL STREAM. NPDES IS
ADMINISTRATIVE BY THE STATE

40 CFR 403:
EFFLUENT GUIDELINES AND
STANDARDS: PRETREATMENT
STANDARDS

DISCHARGES OF EXTRACTED/TREATED
GROUNDWATER WILL BE SUBJECT TO
PRETREATMENT REQUIREMENTS IF
DISCHARGED TO THE POTW

AMBIENT WATER QUALITY CRITERIA

AWQC MAY BE USED FOR DISCHARGE
REQUIREMENTS WHERE THERE ARE NO

STATE WATER QUALITY STANDARDS

CAA SECTION 109 AND 40 CFR 50:
NATIONAL AMBIENT AIR QUALITY
STANDARDS

NAAQS FOR PM10 APPLIED TO
FUGITIVE DUST

40 CFR 404 (B)(1):
WETLAND PROTECTION

PROTECTS THE DESTRUCTION OF
WETLANDS BY REQUIRING NO NET
LOSS OF WETLANDS

OCCUPATIONAL SAFETY AND HEALTH ACT

29 CFR 1910:
GENERAL STANDARDS FOR WORK
PROTECTION

WORKER SAFETY FOR CONSTRUCTION
AND OPERATION OF REMEDIAL ACTION

29 CFR 1910:
REGULATIONS FOR WORKERS
INVOLVED IN HAZARDOUS WASTE
OPERATIONS

WORKER SAFETY FOR CONSTRUCTION
AND OPERATION OF REMEDIAL ACTION

INTERGOVERNMENTAL REVIEW OF FEDERAL PROGRAMS

FISH AND WILDLIFE COORDINATION ACT

PROTECTION OF FISH AND WILDLIFE
WHEN FEDERAL ACTIONS RESULT IN
THE CONTROL OR MODIFICATION OF A
NATURAL STREAM OR BODY OF WATER

ENDANGERED SPECIES ACT

SECTION 7(C)

CONSULTATION WITH THE FISH AND
WILDLIFE SERVICE IF ACTION MAY
IMPACT ENDANGERED SPECIES OR
CRITICAL HABITAT

SAFE DRINKING WATER ACT

MAXIMUM CONTAMINANT LEVELS
(MCLs) ESTABLISHED UNDER THE
SAFE DRINKING WATER ACT WERE
FOUND TO BE RELEVANT AND
APPROPRIATE TO REMEDIAL ACTION
AT THE CAPE FEAR SITE. THE
CLEANUP GOALS FOR GROUNDWATER
WERE ESTABLISHED IN SECTION 4.

REQUIREMENTS TO BE CONSIDERED

EXECUTIVE ORDER 12372

40 CFR 29

STATE AND LOCAL COORDINATION AND
REVIEW OF PROPOSED EPA ASSISTED
PROJECTS

EXECUTIVE ORDERS FOR FLOOD PLAINS (EO 11988)

40 CFR PART 6, SUBPART A

PROTECTION OF FLOOD PLAINS
AFFECTED BY REMEDIAL ACTION

EXECUTIVE ORDERS FOR WETLANDS
(EO 11990)

PROTECTION OF WETLANDS AFFECTED
BY REMEDIAL ACTION

THE PRESENT WORTH COST OF THE PREFERRED REMEDY, INCLUDING ALL
ACTIVITIES, RANGES FROM \$1.4 TO \$1.6 MILLION.